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Update of the 2008 Summer Scotian Shelf and Bay of Fundy Research Vessel Survey

Mise à jour sur le relevé d'été de 2008 effectué par un navire de recherche sur le plateau néo-écossais et dans la baie de Fundy

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ABSTRACT

The 2008 Scotian Shelf summer Research Vessel (RV) survey was conducted between 5 July and 1 August 2008, onboard the *CCGS Wilfred Templeman*. The *Wilfred Templeman* made 97 fishing sets during the first leg of the survey and 82 during the second leg. In Northwest Atlantic Fisheries Organization (NAFO) Divisions 4X5Y (strata 470-495), 75 valid tows were completed, while 90 valid tows were completed in NAFO Divisions 4VW, (strata 440-466), and 5 sets were completed in strata 496-498 (Scotian Shelf edge; depth greater than 200 fm). Hydrographic data were collected at all fishing stations.

There were 97 fish taxa identified from the trawl catch and 106 invertebrate taxa. The number of invertebrate species in 2008 is similar to 2007, and was significantly higher than in the past. This was a result of a broader sampling strategy and the increasing experience of personnel in identification of invertebrates.

Details on data collected, protocols followed, areas covered, and species captured are provided. Trends in abundance, biomass, and area occupied are presented for selected commercial species, and for species for which the data display a pronounced trend.

RÉSUMÉ

Le relevé d'été de 2008 effectué par un navire de recherche (NR) sur le plateau néo-écossais a été mené entre le 5 juillet et le 1er août 2008 à bord du navire de la Garde côtière canadienne *(NGCC) Wilfred Templeman*. Le *Wilfred Templeman* a jeté 97 filets de pêche à l'eau pendant la première partie du relevé et 82 durant la deuxième. Dans la division 4X5Y (strates 470 à 495) de l'Organisation des pêches de l'Atlantique Nord-Ouest (OPANO), 75 traits valides ont été réalisés, alors que 90 l'ont été dans la division 4VW (strates 440 à 466) et cinq calées dans les strates 496 à 498 (bordure du plateau néo-écossais; profondeur supérieure à 200 brasses). En outre, des données hydrographiques ont été recueillies à toutes les stations de pêche.

Quatre-vingt-dix-sept (97) taxons de poissons et 106 taxons d'invertébrés ont été pris. Le nombre d'espèces d'invertébrés pris en 2008 se compare au nombre pris en 2007, et il a été beaucoup plus élevé que par le passé, ce qui s'explique d'une part par la stratégie d'échantillonnage plus vaste et, d'autre part, par l'expérience acquise par le personnel dans l'identification des invertébrés.

Des détails sur les données recueillies, les protocoles suivis, les zones couvertes et les espèces prises sont fournis. De plus, des tendances relatives à l'abondance, à la biomasse et à la zone occupée sont présentées pour certaines espèces commerciales et les espèces pour lesquelles les données montrent une tendance prononcée.

INTRODUCTION

The Department of Fisheries and Oceans (DFO) summer research vessel (RV) survey of the Scotian Shelf and Bay of Fundy has been conducted annually since 1970. The survey follows a stratified random sampling design, and includes both hydrographic sampling and sampling of fish and invertebrates using a bottom otter trawl. These survey data are the primary data source for monitoring trends in species distribution, abundance, and biological condition within the region, and also provide data to the Atlantic Zonal Monitoring Program (AZMP) for monitoring hydrographic variability. This research document is intended to provide a synopsis of the findings of the 2008 survey and to examine these data in the context of long-term survey results.

The bottom trawl survey was designed to provide abundance trends for groundfish residing at depths from about 50m to 400m. Survey indices are expected to be proportional to abundance for most species. The distribution of some species, such as cusk and turbot, may not be fully covered by the survey. Abundance trends for theses species may only provide indication of direction of change over time. Catches of pelagic species, such as herring, may not reflect abundance trends. For all these species, other biological information, such as condition factor will still be relevant.

The survey area has been divided into 3 zones, based on oceanography and biogeography. Trends are shown for the entire survey area, and also for 3 separate regions: Eastern Scotian Shelf (4VW; strata 440-466), Western Scotian Shelf (4X east; strata 470-481), and Gulf of Maine/Bay of Fundy (4X west; strata 482-495. Differences in patterns of fish abundance and species composition are apparent for these regions during the survey.

Plots of the size and distribution of catches are provided for selected species and stratified average catches are compared with past results to provide a general overview of trends in abundance, biomass, and area occupied. For those species where individual fish weights have been collected throughout most of the time-series, trends in condition (Fulton's K) are also included.

Data are presented for the major commercial species, for species which comprise a large part of the survey catch, and for species where the 2008 catch was either unusually high or low. The set of species examined to determine if catches in 2008 were unusual was restricted to those where the area occupied exceeded 7000 square nautical miles (approximately $1/7^{th}$ of the surveyed area) in 2008, or averaged greater than this in the 1970s, the 1980s or the 1990s. The species examined were restricted in this manner to avoid rare species for which catches display high inter-annual variability.

Comparisons of stratified length frequencies for 2007 and 2008 to the long-term mean are also included for major commercial fish species. These data were summarized to assist in reviewing trends in abundance which are directly relevant to fisheries management when they are developing advice on allowable catch; hence, these data are grouped by the applicable stock management areas for each species.

SAMPLING OF TRAWL CATCH

Basic data, total numbers and weight caught, and length frequencies were collected from all successful sets according to instructions in the Groundfish Bottom Trawl Surveys Manual.

Length stratified samples for individual fish weight, one per centimetre (by sex if required), were taken from each set for all fish species. In addition, otoliths were taken from cod, haddock, pollock, white hake, silver hake, cusk, halibut, and herring. Maturity stages were assigned for silver hake, cusk, and halibut. All sampling and set information were entered directly in a database with online data editing using an Oracle-based data entry system (GSE).

Stomachs were collected from selected species according to length stratified requirements. Identification of stomach contents was conducted at sea when possible, while some stomachs were frozen for later analysis.

HYDROGRAPHIC OBSERVATIONS

At all successfully fished stations, profiles of temperature, conductivity (salinity), oxygen concentration, fluorescence, and irradiance (PAR extinction) were obtained with a SBE-25 CTD fitted on a Carousel Rosette deployed by the *CCGS Wilfred Templeman*. Niskin bottles attached to the Rosette collected water from the bottom, 25m and 50m (intermediate depths) when possible, and from 5m (near surface) for the following sampling:

- 5 m: salinity (x1), nutrients (x2), chlorophyll-a (x2), and oxygen determination (x2),
- 25 m: nutrients (x2), chlorophyll-a (x2),
- 50 m: nutrients (x2), chlorophyll-a (x2), and
- Bottom: salinity (x1), nutrients (x2), chlorophyll-a (x2), and oxygen determination (x2).

Oxygen measurements were performed after the CTD cast using an ORION 842 bench meter.

Salinity determinations were made using a Guildline "Portasal" salinometer. Chlorophyll-a samples were processed onboard with a Turner-Designs fluorometer.

Surface temperatures were measured using a VEMCO SEATEMP temperature probe. VEMCO depth/temperature miniloggers were attached to the trawl to monitor bottom water/fishing depth temperature.

Additional sampling was undertaken for the AZMP. At 35 selected stations, vertical zooplankton tows (202 micron mesh ring-net) were made from bottom to surface.

The Halifax hydro station was occupied 3 times during the course of the mission. On each occasion the following sampling was conducted:

- Vertical CTD profile of the entire water column (including a fluorometer sensor and dissolved oxygen probe),
- Two vertical zooplankton net tows from bottom to surface; 1 with each of the 76 and 202 micron ring-nets,
- Secchi depth measurement, and
- Niskin bottles on CTD rosette sampled at 10 depths through the water column - samples analyzed for oxygen, nutrients, salinity, chlorophyll-a, and phytoplankton enumeration.

TRAWL MENSURATION

Scanmar sensors were used to document the trawl characteristics. Wing spread, door spread, headline height, and clearance were all recorded for sets when possible.

RESULTS

The annual DFO research vessel survey of the Scotian Shelf and Bay of Fundy was conducted on the *CCGS Wilfred Templeman* between 5 July and 1 August 2008. The *Wilfred Templeman* completed 176 fishing stations during the survey. This is the lowest number completed since 1985. Overall, 6 tows were designated as unrepresentative either due to net damage or because tow duration was less than 20 minutes. In NAFO divs. 4X5Y (strata 470-495), 75 valid tows were completed, while 90 valid tows were completed in NAFO divs. 4VW (strata 440-466) and 5 sets were completed in strata 496-498 (Scotian Shelf edge; depth > 200 fm), (Figure 1).

The beginning of the survey was delayed 3 days due to mechanical problems on the vessel. An additional day was lost at the beginning of the second leg due to problems with the main winch. Three additional days were added at the end of the survey, following a vessel crew change, but one of these was lost to equipment problems, further restricting ability to complete sampling requirements. As a result, sampling was insufficient in 4VW, with only 1 set completed in strata 453 and 496, and the lowest number in the time-series completed in strata 446, 456, and 458.

There were 97 species of fish recorded during the survey (Table 2). The most frequently captured fish were American plaice, haddock, cod, silver hake, witch flounder, and redfish, while those contributing most to the weight caught were redfish, spiny dogfish, haddock, pollock, and herring.

There were 106 separate invertebrate codes used during the survey (Table 3). This is similar to 2007, and substantially greater than in 2006 when 63 invertebrate species were recorded. This was a result of a broader sampling strategy, and was accomplished through increasing experience of survey personnel in identification of invertebrates. The most frequently captured invertebrates were *Pandalus montagui,* short-fin squid, and sponge while sea cucumbers, short-fin squid, American lobster, and *Pandalus borealis* contributed most to the weight of the invertebrate catch.

Identification of all corals was verified in the lab at the Bedford Institute of Oceanography (BIO) immediately following completion of the survey. Those which were listed as unidentified at-sea had the correct species designation added to the database. A large collection of invertebrates, along with a smaller number of unidentified fish were delivered to BIO for corroboration of at-sea identification.

Non-standard Sampling

A variety of samples were collected in addition to those required as part of standard sampling protocols (Table 4).

Notes on Distribution, Abundance, and Condition of Sampled Species

Individual distribution, biomass, and condition trend plots are included for some of the major fish and invertebrates in the survey catch (tables 2, 3; figures 4-35) and for other species of commercial importance. Data are examined for species which were noted during the 2008 survey as more common than recent years, such as redfish, American lobster, and turbot, or as unusually scarce, such as argentine. In addition, an exploration of survey time-series data indicates that recent large changes in area occupied were found for northern sand lance, halibut, American lobster, and argentine. Length composition charts for those species with sufficient data are also presented.

Total biomass estimate for the Scotia-Fundy summer RV survey is displayed in Figure 2. Data were not traditionally collected on all species; therefore, this estimate is restricted to all vertebrate species plus lobster and squid. There was a large decline in catch in 4VW from 1985 to 1995. The total biomass estimate for 4X is variable, but does not show a significant change over the time-series. This estimate can be heavily influenced by a small number of species. For example, a large catch of dogfish from 4X east in 2007 resulted in the highest biomass estimate for this area in the time-series.

Average condition was also compared for all regions of the Scotia-Fundy summer survey (Figure 3a, b, c). Condition (Fulton's K) was averaged across all species for which data are available. There is a general decline in condition for all areas. Condition was at or near its lowest in the series for all areas in 2004. Condition declined earlier in 4VW, following a declining trend from about 1980 to 2000, and has since remained at a low level compared to most condition values prior to 1993 (Figure 3a). Average condition was low in 4X east in the mid-1980s, improved for several years, then dropped in 1993, and had remained low since then. Average condition in 4X east for 2008 is at its highest since 1992 (Figure 3b). In 4X west, condition was variable prior to the early 1990s, declined around 1993, and has remained low (Figure 3c).

Individual Species Trends

Table 1. Index of individual species summaries and associated figures.

Species	Summary Page	Figure Page
Haddock (*Melanogrammus aeglefinus*)	5	21
Atlantic Cod (Gadus morhua)	5	25
Pollock (Pollachius virens)	5	27
White Hake (Urophycis tenuis)	5	32
Silver Hake (Merluccius bilinearis)	6	36
Redfish (*Sebastes sp.*)	6	39
Halibut (*Hippoglossus hippoglossus*)	6	42
Winter Flounder (*Pseudopleuronectes americanus*)	6	45
American Plaice (*Hippoglossoides platessoides*)	6	48
Witch Flounder (*Glyptocephalus cynoglossus*)	6	51
Spiny Dogfish (*Squalus acanthias*)	6	55
Winter Skate (*Leucoraja ocellata*)	7	56
Thorny Skate (*Amblyraja radiata*)	7	57
Herring (*Clupea harengus*)	7	59
Argentine (*Argentina silus*)	7	61
Turbot (*Reinhardtius hippoglossoides*)	7	63

Species	Summary Page	Figure Page
Cusk (*Brosme brosme*)	7	65
Atlantic Wolffish (*Anarhichas lupus*)	7	65
Monkfish (*Lophius americanus*)	7	66
Red Hake (*Urophycis chuss*)	7	66
Blackbelly Rosefish (*Helicolenus dactylopterus*)	7	67
Northern Sand Lance (*Ammodytes dubius*)	7	67
Longhorn Sculpin	7	68
Ocean Pout (*Macrozoarces americanus*)	7	68
Hagfish (*Myxine glutinosa*)	7	69
Lobster (*Homarus americanus*)	8	69
Short-fin Squid (*Illex illecebrosus*)	8	70
Sea Scallop (*Placopecten magellanicus*)	8	72
Snow Crab (*Chionoecetes opilio*)	8	73
Pandalus montagui	8	74
Pandalus borealis	8	75
Sea Cucumber (*Holothuroidea c.*)	8	75

Large catches of haddock were obtained from sets off southwestern Nova Scotia, and on offshore banks in 4W (Figure 4a). Catches were small in the Bay of Fundy and Gulf of Maine, and the biomass index remains below average in 4X west (Figure 4b). Biomass increased in all areas after the early 1990s, and has fluctuated without trend in 4X east and 4VW. Abundance is below average for lengths >43cm, and, unlike in 2007, numbers are also very low for all lengths <35cm, suggesting poor recruitment (Figure 4c). In 4X east and 4X west, abundance is also below average for large haddock and for small haddock, again suggesting poor recruitment for Age 1 (Figure 4e). Condition of haddock has shown some improvement, but continues to be below average in all regions (Figure 4g).

Atlantic cod were widespread in the survey area; however, there were no sets where catch exceeded 50kg (Figure 5a). Biomass indices for 2008 are the lowest in the series for 4X east and 4X west, and close to the lowest in the series for 4VW (Figure 5b). Abundance indices for 4Vn were below average for all lengths greater than 25cm and well below average at all lengths in 4VsW (Figure 5c,d). Numbers are also low for 4X east and 4X west at almost all lengths, with no cod caught over 75cm (Figure 5e, f). Cod condition has fluctuated without trend in the Bay of Fundy, but shows recent decline in eastern 4X. Condition is improving in 4VW; although it remains lower than in the 1970s (Figure 5g).

Most **pollock** were caught in the Gulf of Maine and near the 4X-4W line (Figure 6a). Biomass estimates remain high compared to recent years in both 4VW and 4X west in 2008 (Figure 6b). Abundance of pollock in the eastern assessment unit (4VW and 4Xmn) is above average for lengths <60cm (Figure 6c). Pollock abundance in the western assessment unit is above average for lengths greater than 60cm, but low for smaller pollock with little indication of recruitment (Figure 6d). Pollock condition declined in all regions of the survey in the early 1990s, and has remained low but stable since then (Figure 6f).

White hake were distributed throughout the survey area, with the largest catches in the Gulf of Maine and off Cape North (Figure 7a). Biomass indices display high inter-annual variability, but have declined in general since the mid-1980s (Figure 7b). Abundance was below average for all lengths for 4VW and most lengths in 4X east (Figure7c, d). White hake abundance indices in 4X west were near average for most lengths and had increased from 2007 (Figure 7e). Condition for white hake in 2008 is near the average value since 1995 for all areas (Figure 7f).

Catches of **silver hake** in the 2008 survey were widespread, with the exception of the Eastern Shelf (Figure 8a). The survey biomass index remains near the lowest level in the series for all regions in 2008 (Figure 8b). Abundance indices were well below average for silver hake above 25cm, and near average at lengths below 25cm (Figure 8c). Silver hake condition declined in all areas during the early 1990s. Condition has increased since 2000, but remains below average (Figure 8d).

Redfish are well distributed throughout the survey area, with larger sets coming primarily from 4V and eastern 4X (Figure 9a). Biomass indices increased for all areas in 2008, with record high indices in 4X (Figure 9b). A strong mode is apparent in the indices at length for both unit II and unit III, with some progression in modal length from 2007 to 2008, which suggests it is tracking a strong year-class (Figure 9c). There is no recent trend in condition in any region, but condition in all regions remains lower than average (Figure 9e).

Halibut were widely caught in the survey area (Figure 10a). Biomass reached a record high for the survey in 2007 and remains high for all regions in 2008 (Figure 10b). Abundance is above average for most lengths greater than 31cm (Figure 10c). There is no clear trend in condition for halibut (Figure 10d).

Winter flounder were caught mainly in the Bay of Fundy with smaller catches also occurring on Browns Bank and Western Bank (Figure 11a). Biomass indices declined in both 4VW and eastern 4X for 2008, but increased in 4X west, where it was among the highest in the series (Figure 11b). Abundance of winter flounder is below average for most lengths in 4X east (Figure 11c), while numbers are above average for almost all lengths in 4X west (Figure 11d). Winter flounder condition displays a declining trend in 4X, but has been stable in 4VW since 1995 (Figure 11e).

American plaice were widespread on the Scotian Shelf during the 2008 survey, with the largest catches primarily in 4V (Figure 12a). Biomass remains low in 4X. Biomass has remained stable in 4VW since 1995, but remains low compared to the 1970s and 1980s (Figure 12b). Abundance at length in 4VW was at or above average for lengths less than 25cm in 2007 and 2008, but below average for larger fish (Figure 12c). American plaice condition has fluctuated without trend in western 4X, but has declined in 4X east and has remained at a low level since 2006. In 4VW, condition has been stable for the last decade at a lower level than in earlier years (Figure 12d).

Witch flounder were caught throughout the survey area, with the largest catches all from 4V (Figure 13a). Witch Flounder biomass has remained low in western 4X since the 1980s, and has been low but without trend in 4X east throughout the time-series. In 4VW, biomass has followed an increasing trend since the early 1990s (Figure 13b). Witch flounder abundance in 4VW is above average for most lengths less than 39cm (Figure 13c). Abundance indices are well below average for most lengths in 4X east, and much lower than in the 2007 survey (Figure 13d). Abundance indices in 4X west are near or above average for most lengths less than 39cm (Figure 13e). . Larger witch flounder (>43cm) have been a major part of the population in 4X, but were completely absent from the survey catches in 2007 and 2008. Condition declined in all areas for 2008 and remains low (Figure 13f).

Spiny dogfish were caught almost exclusively in 4X, with most catches coming from the Bay of Fundy and Gulf of Maine (Figure 14a). Biomass estimates for dogfish are quite variable from year to year, with no clear trend in the past decade (Figure 14b). There is no clear trend in condition for dogfish (Figure 14c).

The largest catches of **winter skate** came from Browns Bank and the Bay of Fundy in 2008 (Figure 15a). Winter skate biomass remains at a low level (Figure 15b).

The largest catches of **thorny skate** came from 4V (Figure 16a). Biomass remains low in 4X but appears stable. Thorny skate biomass in 4VW decreased for 2008 to the second lowest level in the series (Figure 16b).

Atlantic herring were caught mainly on the Central Scotian Shelf and in the Bay of Fundy (Figure 17a). Biomass has dropped sharply in all areas since 2004, but it is not clear that survey catches reflect population biomass for herring, due to their primarily pelagic distribution (Figure 17b). Condition has increased to about average in 4X east and 4VW, but remained below average in 4X west in 2008 (Figure 17c).

Argentine were present in very few tows in 2008 (Figure 18a). Biomass (Figure 18b) and area occupied (Figure18c) are at or among record lows for the survey series. It is not clear if survey catches are reflecting population biomass trends for either herring or argentine. These species are primarily pelagic, and small changes in vertical distribution may strongly influence bottom trawl catches.

The largest **turbot** catches came from 4V (Figure 19a). Biomass indices have increased ten-fold since 1990, and were the highest on record in 2008 (Figure 19b). Stratified area occupied remained among the highest in the series in 2008 (Figure 19c).

Cusk catches have declined throughout the series and biomass reached a record low in 2008 (Figure 20).

Atlantic wolffish biomass has shown some increase in 4VW since 2004, but remains at a low level in all areas (Figure 21).

Few **monkfish** were caught in the 2008 survey and biomass appears to be low but stable (Figure 22).

Red hake biomass shows a declining trend since the mid-1990s. For 2008, biomass in 4VW increased, while 4X east showed a decline, and 4X west remained stable at a low level (Figure 23).

Biomass of **blackbelly rosefish** decreased from the series high in 2006, but remains well above average in 2008 (Figure 24).

Northern sand lance biomass has followed a declining trend since 2000, but remains above average for the series in 2008 (Figure 25). The sand lance catch comes almost entirely from 4VW.

Longhorn sculpin biomass has varied without trend in both 4VW and 4X west, but has recently shown increase in 4X east (Figure 26).

Ocean pout biomass has been in decline since the mid-1990s. Biomass in all areas is among the lowest in the series in 2008 (Figure 27).

Biomass of **northern hagfish** has been variable, and in 2008 has declined in all areas (Figure 28).

American lobster was caught in most sets in 4X, with very few catches in 4VW (Figure 29a). Although biomass declined in 4VW and 4X east for 2008, overall biomass remains high (Figure 29b).

Short-fin squid were caught throughout the survey area, but most catches occurred along the shelf edge (Figure 30a). Survey catches show high inter-annual variability, and are near average in 2008 (Figure 30b).

Most other invertebrates in the catch have a shorter time-series (1999-present).

Sea scallop catches came mainly from 4WX (Figure 31a). Biomass increased in 4VW while it declined in 4X. Biomass has been low in 4X east since 2005, and has varied without trend in 4X west and 4VW (Figure 31b).

Catches of **snow crab** occurred primarily in the eastern portion of 4VW and were rarely encountered in 4X (Figure32a). Biomass in 2008 is the second highest in the series (Figure 32b).

Pandalus montagui (pink shrimp) were distributed widely throughout the survey area (Figure 34). ***Pandalus borealis*** (northern shrimp) were primarily found in 4VW, with isolated catches in 4X (Figure 34).

Sea cucumber was caught in 4X east and 4VW, with the largest catches by weight taken from Middle Bank, near Sable Island and Banquereau (Figure 35).

Bottom Temperature and Salinity

Temperature and salinity data were collected at each station from the 2008 survey. Contour plots of these data show general patterns of water masses in the region (Figure 36a, b). The general patterns are consistent with past years, with the coldest water on the Eastern Scotian Shelf, warm saline water in the Central Scotian Shelf and Georges Basin, and warm water of low salinity in the Bay of Fundy.

CONCLUSIONS

The minimum survey station coverage was not achieved in 2008. The total number of valid tows was the lowest since 1985. Lost time resulting from vessel mechanical delays resulted in low sampling of 4W. Minimum sampling requirements were not met in strata 453 and 496, and sampling was the lowest in the survey series in several other strata.

Increased effort on identification of invertebrates has resulted in a much higher number of invertebrate species recorded. Further development of field identification guides is needed to ensure these species can be recorded consistently on future surveys.

The total biomass observed in the survey has declined over time in 4VW, but has varied without trend in 4X. Despite the lack of any declining trend in total biomass for the survey in 4X east and 4X west, biomass was low for most species in 2008. Data summaries extending back to 1970 are included in this research document for 25 species; of these, 9 were above average biomass in 2008 in 4X west, 5 in 4X east, and 6 in 4VW. There is some consistency in which species are above average among the regions. Halibut, sand lance, and lobster biomass are above average

in all 3 areas. Redfish and longhorn sculpin were above average biomass in both 4X east and 4X west, while pollock and blackbelly rosefish are both above average in 4X west and 4VW. Also above average in biomass are turbot in 4VW, spiny dogfish in 4X west, and winter flounder in 4X west.

Many of the species that are above average biomass are found primarily in deep water; but not all deep water species show this trend. Deep water species like cusk, monkfish, and white hake are currently at very low biomass. Turbot and blackbelly rosefish have effectively colonized parts of the Scotian Shelf. These species have moved onto the shelf from deeper water. The trends in their abundance at depths greater than 500m – 700m is unknown.

In 4X west, above average biomass was recorded for a wider variety of species, including deep water species, species associated with shallow coastal waters, such as winter flounder, longhorn sculpin, and spiny dogfish, which is caught at a variety of depths. While many species, including cod, are at very low biomass in 4X west, depleted biomass is less prevalent in this area.

The survey data are available on divisional databases for more detailed analyses.

Table 2. Summary of vertebrate catch from the 2008 Scotia-Fundy summer research vessel survey.

Species Code	Common Name	Scientific Name	Sets Occupied	Total Weight (Kg)	Total Number	Age Samples	Stomach Samples
40	American Plaice	Hippoglossoides platessoides	120	581	3701		417
11	Haddock	Melanogrammus aeglefinus	99	4570	7458	1331	486
10	Cod(Atlantic)	Gadus morhua	96	481	661	425	239
14	Silver Hake	Merluccius bilinearis	92	718	7077	1066	349
41	Witch Flounder	Glyptocephalus cynoglossus	91	162	839		71
23	Redfish Unseparated	Sebastes sp.	88	12399	72219		483
60	Herring(Atlantic)	Clupea harengus	82	834	5269		
12	White Hake	Urophycis tenuis	74	539	702	386	185
300	Longhorn Sculpin	Myoxocephalus octodecemspinosus	63	246	1486		134
42	Yellowtail Flounder	Limanda ferruginea	57	287	1699		126
201	Thorny Skate	Amblyraja radiata	56	247	619		131
320	Sea Raven	Hemitripterus americanus	48	187	338		132
13	Squirrel or Red Hake	Urophycis chuss	41	44	310		117
43	Winter Flounder	Pseudopleuronectes americanus	41	374	1118		137
30	Halibut(Atlantic)	Hippoglossus hippoglossus	40	287	95	90	69
340	Alligatorfish	Aspidophoroides monopterygius	40	1	426		
16	Pollock	Pollachius virens	38	2260	1266	231	94
610	Northern Sand Lance	Ammodytes dubius	38	382	24928		49
220	Spiny Dogfish	Squalus acanthias	35	5917	3595		82
400	Monkfish,Goosefish,Angler	Lophius americanus	32	88	62		41
62	Alewife	Alosa pseudoharengus	31	112	982		
640	Ocean Pout(Common)	Macrozoarces americanus	31	13	62		3
202	Smooth Skate	Malacoraja senta	30	13	44		26
304	Mailed Sculpin	Triglops murrayl	27	2	260		
50	Striped Atlantic Wolffish	Anarhichas lupus	26	36	142		42
203	Little Skate	Leucoraja erinacea	21	82	167		4
31	Turbot,Greenland Halibut	Reinhardtius hippoglossoides	20	446	856		82
623	Daubed Shanny	Lumpenus maculatus	19	5	1014		24
61	Shad American	Alosa sapidissima	18	146	213		
204	Winter Skate	Leucoraja ocellata	18	83	119		34
112	Longfin Hake	Urophycis chesteri	17	18	216		68

Species Code	Common Name	Scientific Name	Sets Occupied	Total Weight (Kg)	Total Number	Age Samples	Stomach Samples
123	Rosefish(Black Belly)	Helicolenus dactylopterus	16	58	376		5
114	Fourbeard Rockling	Enchelyopus cimbrius	13	1	33		
410	Marlin-Spike Grenadier	Nezumia bairdii	12	1	45		12
350	Atlantic Sea Poacher	Leptagonus decagonus	11	1	39		
241	Northern Hagfish	Myxine glutinosa	10	1	17		
501	Lumpfish	Cyclopterus lumpus	10	13	13		8
622	Snake Blenny	Lumpenus lumpretaeformis	10	1	59		10
64	Capelin	Mallotus villosus	9	0.4	30		6
200	Barndoor Skate	Dipturus laevis	8	31	11		
620	Laval's Eelpout	Lycodes lavalaei	8	2	29		5
880	Hookear Sculpin, Atl.	Artediellus atlanticus	8	<1	16		1
306	Snowflake Hookear Sculpin	Artediellus uncinatus	7	<1	24		
647	Shorttailed Eelpout(Vahl)	Lycodes vahlii	7	4	49		10
160	Argentine(Atlantic)	Argentina silus	6	1	9		6
502	Atlantic Spiny Lumpsucker	Eumicrotremus spinosis	6	<1	13		
712	White Barracudina	Notolepis rissoi	6	1	78		
15	Cusk	Brosme brosme	5	13	9	9	6
19	Off-Shore Hake	Merluccius albidus	5	10	8		4
301	Shorthorn Sculpin	Myoxocephalus scorpius	5	1	6		1
625	Radiated Shanny	Ulvaria subbifurcata	5	<1	23		
44	Gulf Stream Flounder	Citharichthys arctifrons	4	<1	8		
302	Arctic Staghorn Sculpin	Gymnocanthus tricuspis	4	<1	7		
303	Grubby or Little Sculpin	Myoxocephalus aenaeus	4	<1	12		
17	Tomcod(Atlantic)	Microgadus tomcod	3	1	34		1
149	Longnose Greeneye	Parasudis truculenta	3	<1	3		
150	Lanternfish (NS)	Myctophidae	3	<1	205		
159	Boa Dragonfish	Stomias boa	3	4	253		
314	Spatulate Sculpin	Icelus spatula	3	<1	7		
603	Wolf Eelpout	Lycenchelys verrilli	3	<1	8		
604	Snipe Eel	Nemichthys scolopaceus	3	<1	10		
630	Wrymouth	Cryptacanthodes maculates	3	2	3		
811	Myctophiformes	Myctophiformes O.	3	<1	7		
142	Fourspot Flounder	Hippoglossina oblonga	2	<1	2		

Species Code	Common Name	Scientific Name	Sets Occupied	Total Weight (Kg)	Total Number	Age Samples	Stomach Samples
143	Brill/Windowpane	Scophthalmus aquosus	2	<1	4		
313	Two Horn Sculpin	Icelus bicornis	2	<1	7		
323	Hookear Sculpin (NS)	Artediellus sp.	2	<1	4		
520	Sea Tadpole	Careproctus reinhardti	2	<1	2		
617	Common Wolf Eel	Lycenchelys paxillus	2	<1	4		
619	Eelpout,Newfoundland	Lycodes terraenova	2	5	15		8
621	Rock Gunnel(Eel)	Pholis gunnellus	2	<1	2		
646	Atlantic Soft Pout	Melanostigma atlanticum	2	<1	7		
816	Tongue Fish	Symphurus diomedeanus	2	<1	2		
1054	Duckbill Barracudina	Paralepis atlantica Kroyer	2	<1	4		
51	Spotted Wolffish	Anarhichas minor	1	<1	1		1
63	Rainbow Smelt	Osmerus mordax	1	<1	3		
70	Mackerel(Atlantic)	Scomber scombrus	1	<1	1		
113	Blue Antimora/Hake	Antimora rostrata	1	<1	1		
118	Greenland Cod	Gadus ogac	1	2	7		
122	Cunner	Tautogolabrus adspersus	1	<1	1		
157	Glacier Lanternfish	Benthosema glaciale	1	<1	203		
180	Spotted Lanternfish	Myctophum punctatum	1	<1	2		
183	Lanternfish Patchwork	Notoscopelus resplendens	1	<1	1		
221	Black Dogfish	Centroscyllium fabricii	1	24	81		
307	Polar Sculpin	Cottunculus microps	1	<1	1		
309	Sculpin (NS)	Triglops sp.	1	<1	1		
376	Polyipnus sp.	Polyipnus sp.	1	<1	1		
506	Greenland Seasnail	Liparis tunicatus	1	<1	4		
593	Greeneyes (NS)	Chlorophthalmidae	1	<1	1		
602	Gray's Cutthroat Eel	Synaphobranchus kaupi	1	<1	8		
616	Fish Doctor	Gymnelis viridis	1	<1	1		
701	Butterfish	Peprilus triacanthus	1	<1	1		
711	Short Barracudina	Paralepis atlantica	1	<1	2		
714	Simonyi's Frostfish	Benthodesmus simonyi	1	<1	2		
730	Ocean Sunfish	Mola mola	1	40	1		
746	Northern Puffer	Sphoeroides maculates	1	<1	1		
784	Black Scabbardfish	Aphanopus carbo	1	<1	1		

Table 3. Summary of invertebrate catch from the 2008 Scotia-Fundy summer research vessel survey.

Species Code	Common Name	Scientific Name	Sets Occupied	Total Weight (Kg)	Total Number
2212	Pandalus montagui	Pandalus montagui	102	125	69435
4511	Short-fin Squid	Illex illecebrosus	94	683	6256
8600	Sponges	Porifera P.	76	155	192
6100	Asteroidea S.C.	Asteroidea S.C.	68	16	407
6117	Hippasteria phrygiana	Hippasteria phrygiana	68	30	284
2526	Snow crab (Queen)	Chionoecetes opilio	63	266	1851
4521	Octopus	Octopoda O.	57	3	147
8300	Sea Anemone	Anthozoa C.	57	35	267
6123	Sun Star	Solaster papposus	51	22	396
2511	Jonah Crab	Cancer borealis	50	31	166
6600	Sea Cucumbers	Holothuroidea C.	49	1824	265
2550	American Lobster	Homarus americanus	48	437	383
6115	Mud Star	Ctenodiscus crispatus	48	3	219
6200	Brittle Star	Ophiuroidea S.C.	48	7	183
8500	Jellyfishes	Scyphozoa C.	47	17	76
1823	Sea Potato	Bolentia SP.	45	68	254
6119	Blood Star	Henricia sanguinolenta	45	2	1106
2521	Hyas Coarctatus	Hyas coarctatus	42	8	214
4210	Whelks	Buccinum SP.	41	23	128
4321	Sea Scallop	Placopecten magellanicus	37	38	465
6110	Asterias sp.	Asterias SP.	37	26	481
6411	Green Sea Urchin	Strongylocentrotus droebachiensis	37	155	313
6121	Purple sunstar	Solaster endeca	33	68	203
2559	Hermit Crabs	Paguridae F.	32	2	96
2523	Northern Stone Crab	Lithodes maja	29	25	88
2513	Atlantic Rock Crab	Cancer irroratus	28	54	607
2527	Toad Crab	Hyas araneus	27	5	91
6300	Basket Stars	Gorgonocephalidae,Asteronychidae F.	26	98	6
2411	Argis dentata	Argis dentate	25	8	1996
6111	Purple Starfish	Asterias vulgaris	25	48	300
2211	Pandalus borealis	Pandalus borealis	23	387	47165
4536	Sepiolidae F.	Sepiolodae F.	22	<1	119

Species Code	Common Name	Scientific Name	Sets Occupied	Total Weight (Kg)	Total Number
6511	Echinarachnius parma	Echinarachnius parma	22	7	212
5100	Sea Spider	Pycnogonida S.P.	21	<1	216
3212	Aphrodita SP.	Aphrodita SP.	19	<1	32
2560	Paguroidea S.F.	Paguroidea S.F.	15	3	46
2221	Pasiphaea multidentata	Pasiphaea multidentata	14	9	3107
2600	Krill Shrimp	Euphausiacea O.	14	2	3776
4322	Iceland Scallop	Chlamys islandica	14	2	35
6500	Sand Dollars	Clypeasteroida O.	13	2	93
1810	Tunicata S.P.	Tunicata S.P.	12	3	35
4200	Snails and Slugs	Gastropoda O.	11	3	33
6113	Leptasterias polaris	Leptasterias polaris	11	4	35
8324	Sea Cauliflower, Strawberries	Eunephthya rubiformis	10	<1	3
2312	Lebbeus polaris	Lebbeus polaris	9	<1	1182
2316	Spirontocaris spinus	Spirontocaris spinus	9	<1	493
2990	Barnacles	Cirripedia S.C.	9	8	43
3100	Bristle Worms	Polychaeta C.	9	<1	38
3501	Lepidonotus squamatus	Lepidonotus squamatus	9	<1	66
6400	Sea Urchins	Strongylocentrotus sp.	9	4	139
8336	Dead Mans Fingers	Alcyonium digitatum	9	2	2
8318	Sea Pen	Pennatulacea	8	9	19
8601	Russian Hats	Vazella pourtalesi	8	20	19
2611	Meganyctiphanes norvegica	Meganyctiphanes norvegica	7	4	8007
2310	Spirontocaris	Spirontocaris sp.	6	<1	285
3000	Segmented Worms	Annelida P.	6	<1	13
8332	Coral (NS)	Anthozoa	6	1	0
2313	Spirontocaris liljeborgii	Spirontocaris liljeborgii	5	<1	81
2319	Lebbeus groenlandicus	Lebbeus groenlandicus	5	<1	28
2414	Sclerocrangon boreas	Sclerocrangon boreas	5	1	162
2415	Pontophilus norvegicus	Pontophilus norvegicus	5	<1	67
2416	Crangon SP.	Crangon sp.	5	<1	129
2532	Red Deepsea Crab	Chaceon quinquedens	5	9	50
2800	Amphipoda O.	Amphipoda O.	5	<1	5
2980	Isopoda O.	Isopoda O.	5	<1	4
4330	Mussels (NS)	Mytilidae F.	5	<1	25

Species Code	Common Name	Scientific Name	Sets Occupied	Total Weight (Kg)	Total Number
4400	Sea Slugs	Nudibranchia O.	5	<1	9
6125	Pteraster militaris	Pteraster militaris	5	<1	31
2213	Was Pandalus propinquus	Atlantopandalus propinqvus	4	<1	64
2320	Lebbeus sp.	Lebbeus sp.	4	<1	35
4310	Clams (NS)	Protobranchia, Heterodonta	4	<1	8
4312	Bank Clam	Cyrtodaria siliqua	4	<1	8
1827	Sea Peach	Halocynthia pyriformis	3	2	11
2100	Shrimps	Decapoda O.	3	<1	52
2700	Mysid Shrimp	Mysidacea O.	3	<1	261
3200	Sea Mouse	Aphrodita hastate	3	<1	4
4211	Wave Whelk,Common Edible	Buccinum undatum	3	<1	4
6413	Heart Urchin	Brisaster fragilis	3	<1	21
1932	Terebratulina sp.	Terebratulina sp.	2	<1	7
2541	Axius serratus	Axius serratus	2	<1	1
2621	Thysanoessa raschii	Thysanoessa raschii	2	<1	7
2906	Hyperiidae F.	Hyperiidae F.	2	<1	2
2940	Tanaidae F.	Tanaidae F.	2	<1	0
4355	Stimpson's Surf Clam, Arctic Surf Clam	Mactromeris polynyma	2	<1	6
1821	Sea Squirts	Ascidia sp.	1	<1	0
2219	Pasiphaeidae F.	Pasiphaeidae F.	1	5	4430
2330	Eualus sp.	Eualus sp.	1	<1	5
2333	Eualus gaimardii	Eualus gaimardii	1	<1	5
2400	Crangonidae F.	Crangonidae F.	1	<1	2
2417	Crangon septemspinosa	Crangon septemspinosa	1	<1	6
2520	Toad Crab,Unident.	Hyas sp.	1	<1	5
2566	Munidopsis curvirostra	Munidopsis curvirostra	1	<1	5
3164	Spionida F.	Spionida F.	1	<1	0
4221	Northern Moonsnail	Euspira heros	1	<1	1
4300	Bivalvia C.	Bivalvia C.	1	<1	3
4331	Common Mussels	Mytilus edulis	1	<1	3
4350	Nut Shells	Nuculidae F.	1	<1	1
4431	Giant Canoe Bubble	Scaphander punctostriatus	1	<1	1
4514	Squid (NS)	Loliginidae,Ommastrephidae F.	1	<1	4

Species Code	Common Name	Scientific Name	Sets Occupied	Total Weight (Kg)	Total Number
4520	Octopus	Incirrina S.O.	1	<1	1
6000	Spiny Skinned Animals	Echinodermata P.	1	<1	3
6421	Purple-Spined Sea Urchin	Arbacia punctulata	1	<1	1
8327	Soft Coral Unidentified	Soft Coral Unidentified	1	<1	0
8335	Cup Coral	Flabellum sp.	1	<1	2
8347	Psilaster andromeda	Psilaster andromeda	1	<1	0
8530	Sea Corals (NS)	Sea Corals (NS)	1	<1	0

Table 4. Special sampling conducted during the 2008 Scotia-Fundy summer research vessel survey.

Cod > 40cm	50 fish > 40cm collected
Whole specimens of Haddock, Silver Hake, White Hake	2 of each species collected
White Hake >44cm	63 specimens collected
Hagfish	17 whole specimens collected
Cusk	9 whole specimens collected
Ocean Pout	62 whole specimens collected
Witch Flounder	839 whole specimens collected
Longhorn Sculpin	1486 whole specimens collected
Skate Purses	8 skate purses collected
District 10 School Collection	22 species of fish and invertebrates collected
Skate (Little, Thorny, Winter, Smooth)	Male and female specimens of each species – photographed, tissue sample collected, and whole specimens retained
Identification	43 specimens photographed and retained for identification
Sponge	Variety of sponges collected for identification

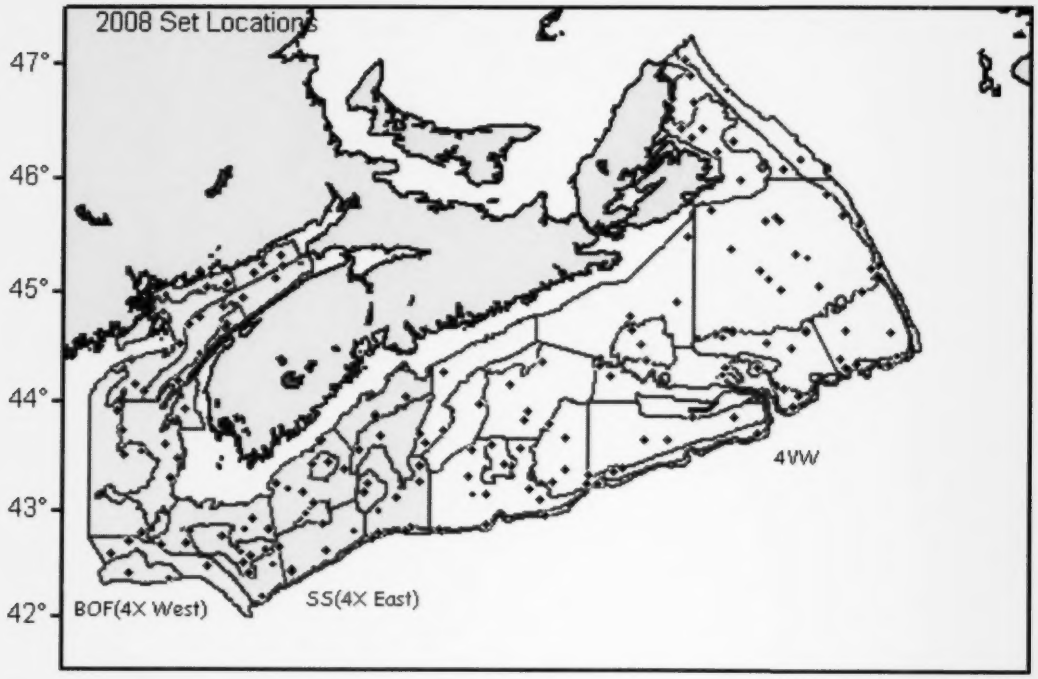

Figure 1. Station locations and geographical zones from the 2008 Scotia-Fundy summer research vessel survey (blue=4X west, green=4X east, yellow=4VW).

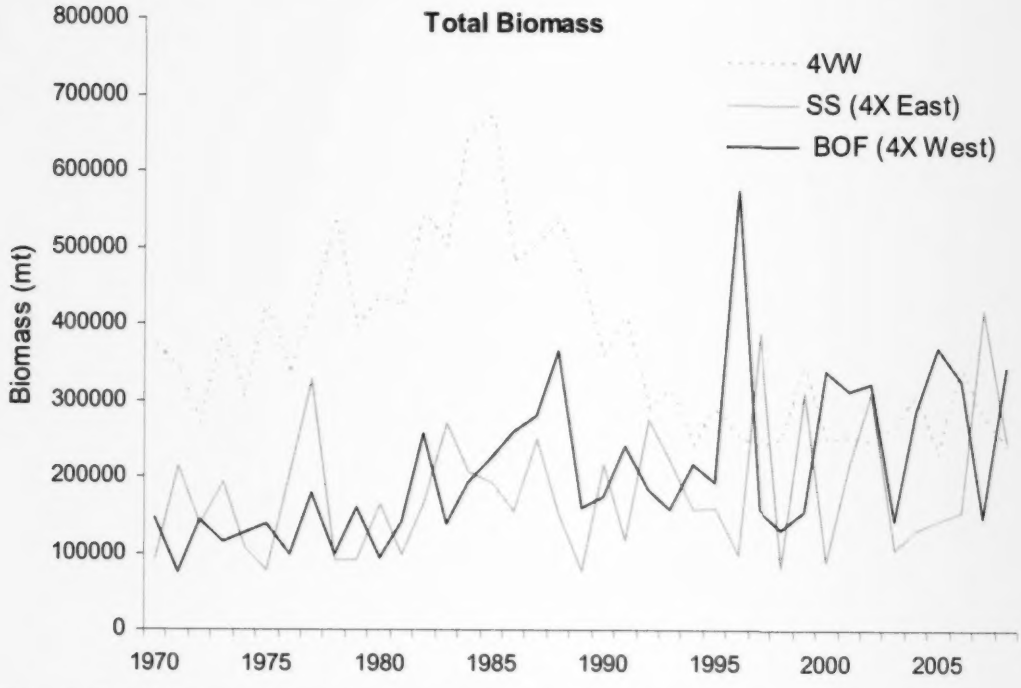

Figure 2. Total biomass estimate from the Scotia-Fundy summer research vessel survey.

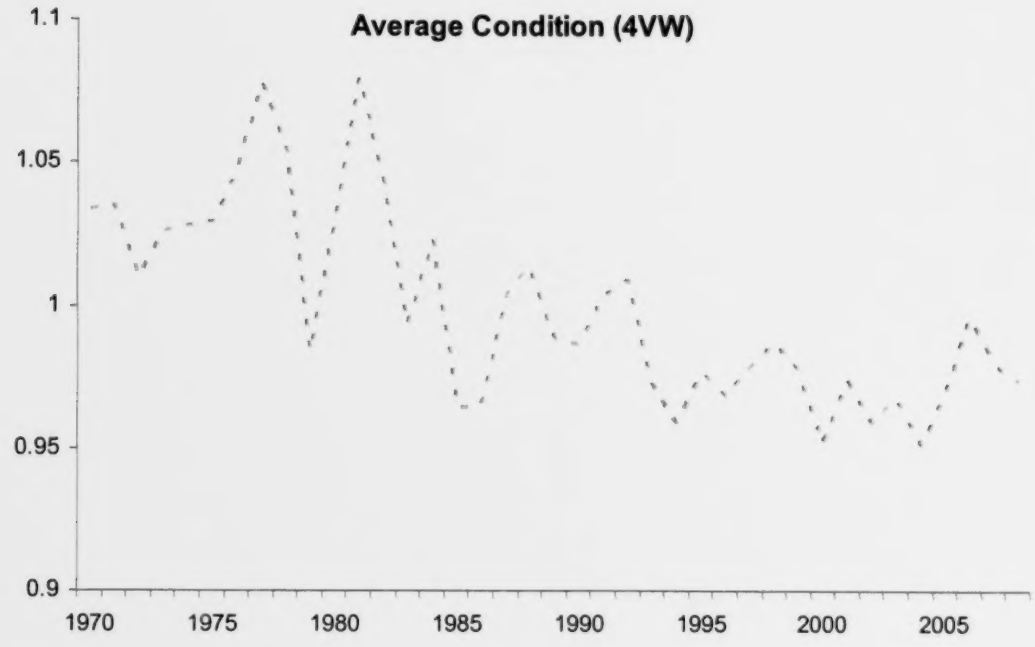

Figure 3a. Average condition (Fulton's K) in NAFO divs. 4VW from the Scotia-Fundy summer research vessel survey.

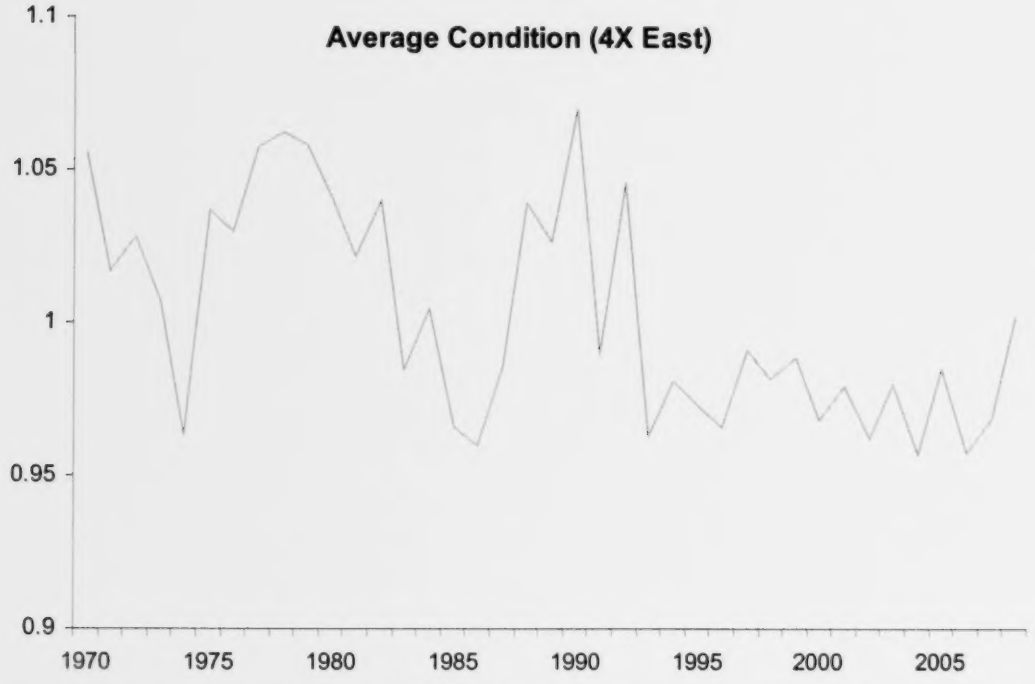

Figure 3b. Average condition (Fulton's K) in NAFO Div. 4X (Scotian Shelf) from the Scotia-Fundy summer research vessel survey.

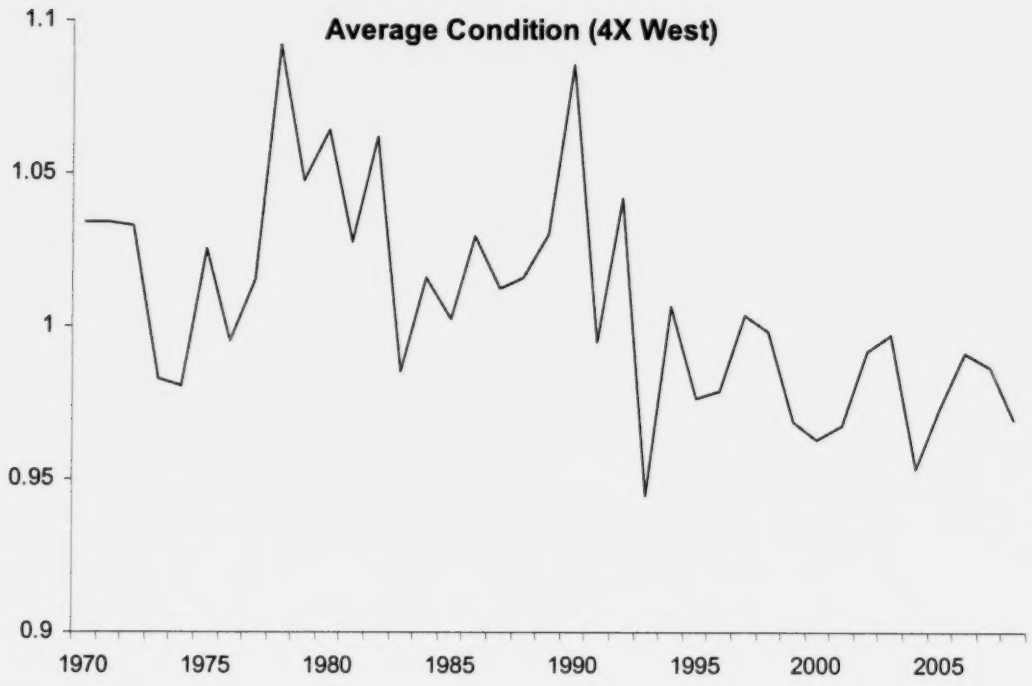

Figure 3c. Average condition (Fulton's K) in NAFO Div. 4X (Bay of Fundy) from the Scotia-Fundy summer research vessel survey.

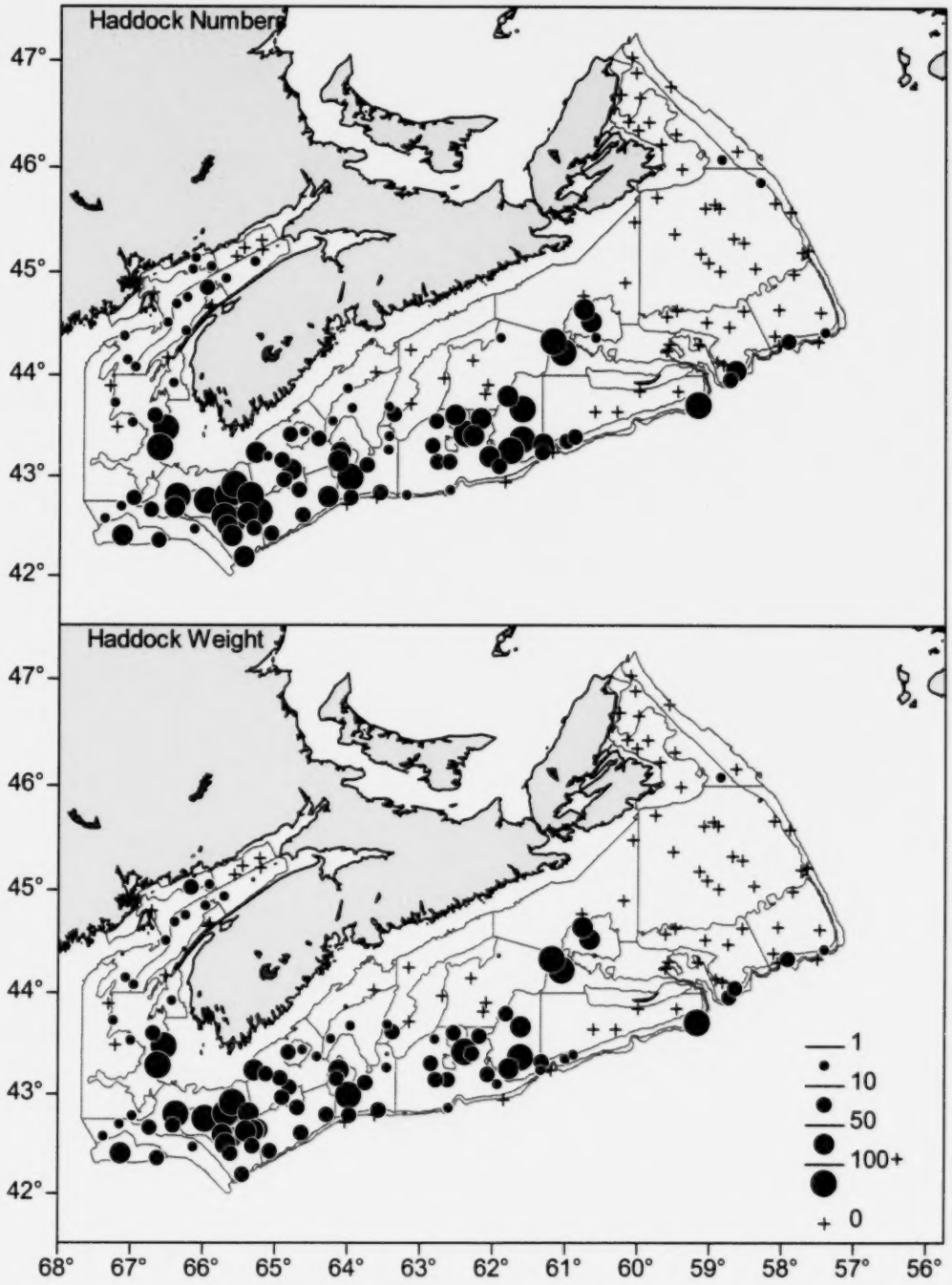

Figure 4a. Distribution of haddock catches during the 2008 Scotia-Fundy summer research vessel survey.

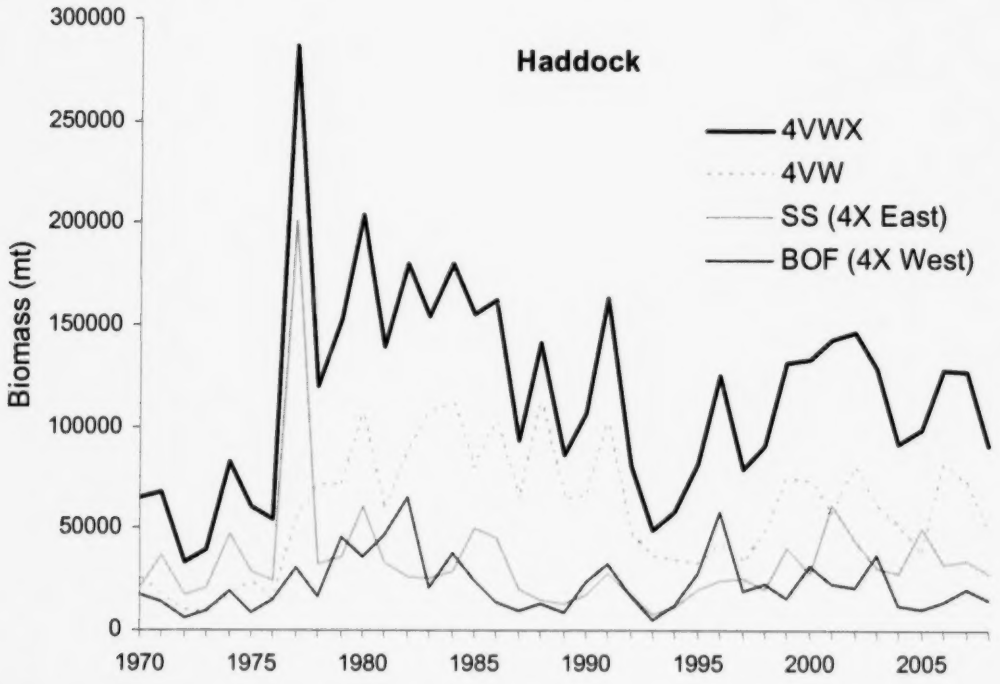

Figure 4b. Biomass estimate for haddock from the Scotia-Fundy summer research vessel survey.

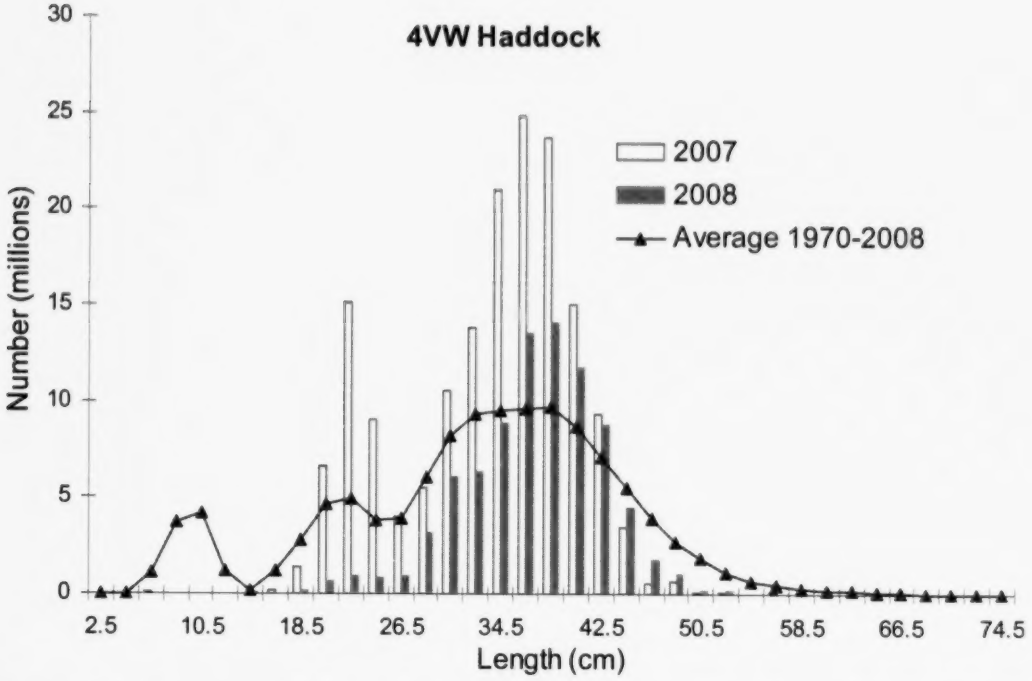

Figure 4c. Length composition for haddock in NAFO divs. 4VW from the Scotia-Fundy summer research vessel survey.

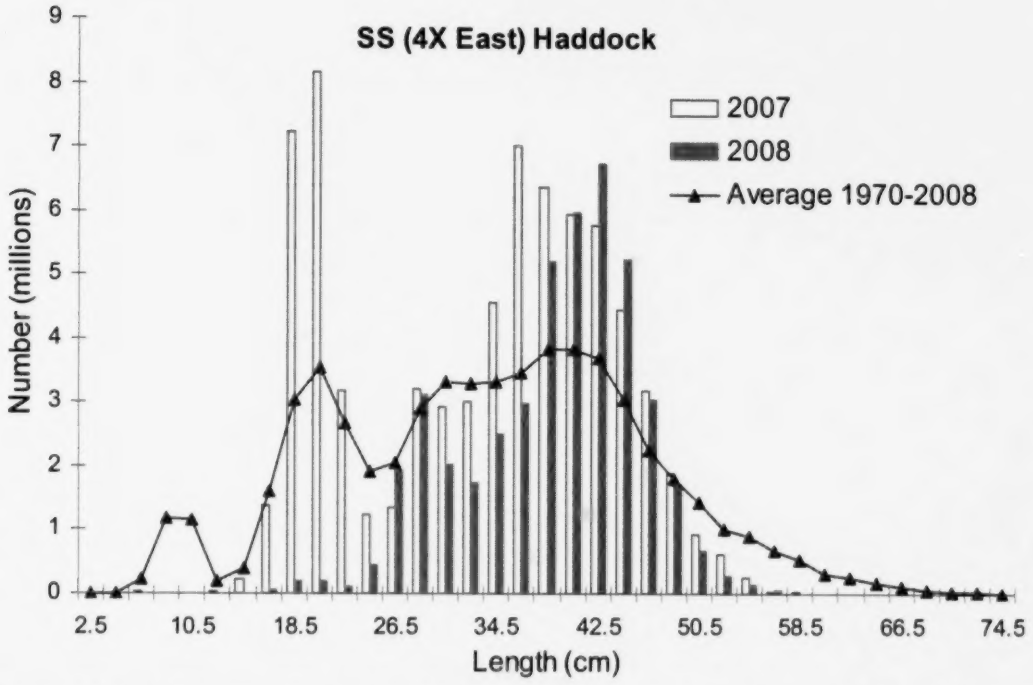

Figure 4d. Length composition for haddock in NAFO Div. 4X east from the Scotia-Fundy summer research vessel survey.

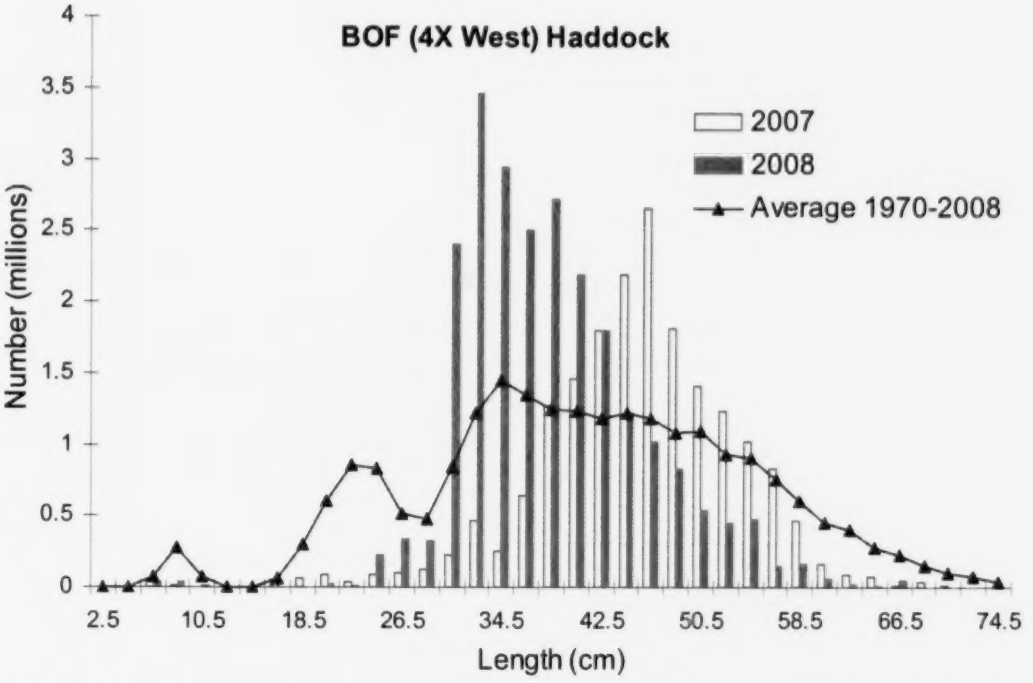

Figure 4e. Length composition for haddock in NAFO Div. 4X west from the Scotia-Fundy summer research vessel survey.

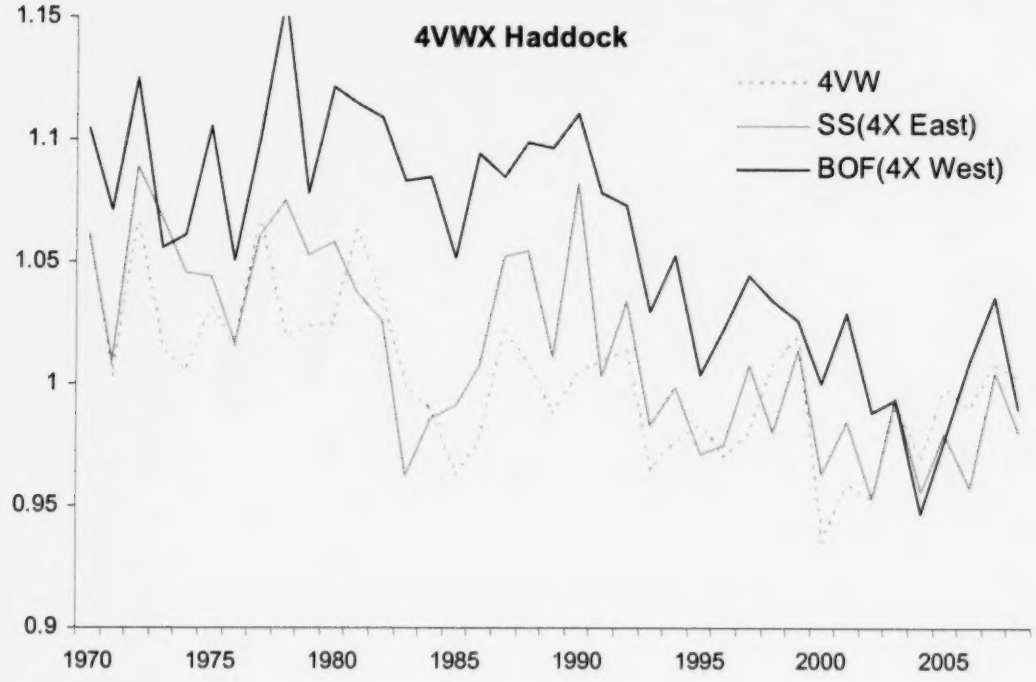

Figure 4f. Condition factor (Fulton's K) for haddock from the Scotia-Fundy summer research vessel survey.

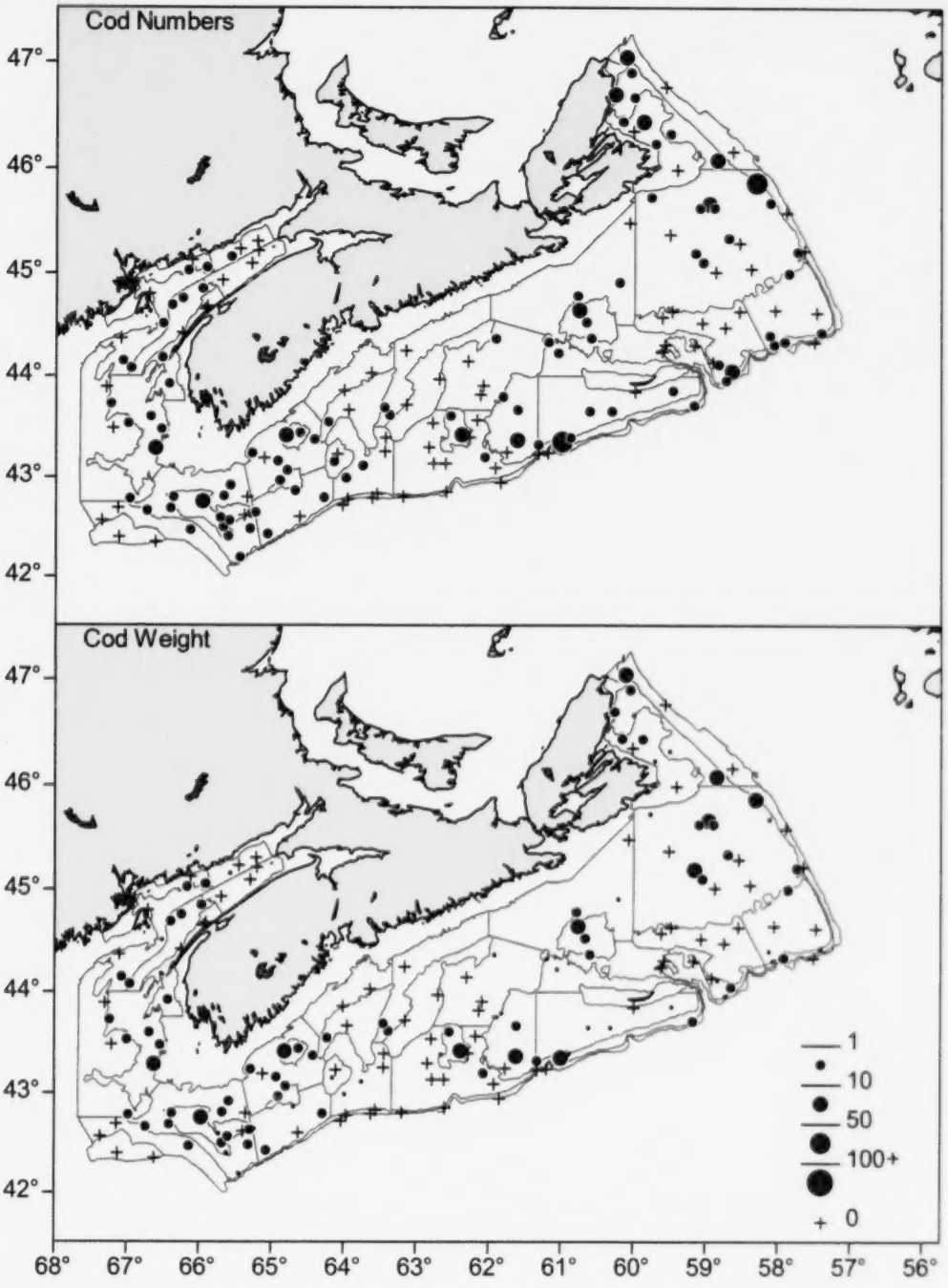

Figure 5a. Distribution of cod catches during the 2008 Scotia-Fundy summer research vessel survey.

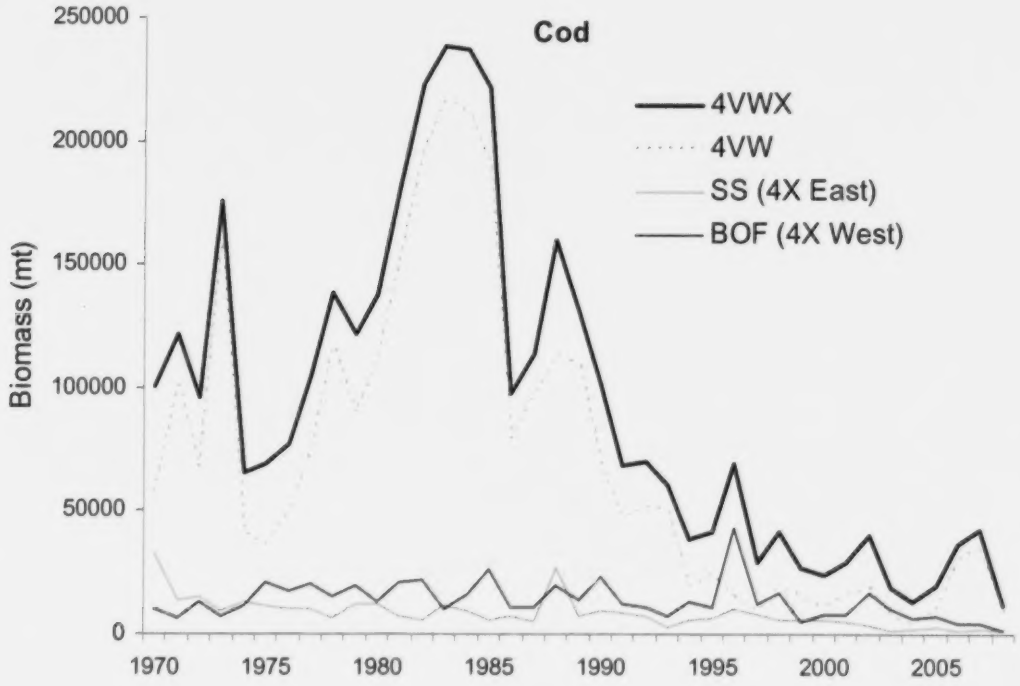

Figure 5b. Biomass estimate for cod from the Scotia-Fundy summer research vessel survey.

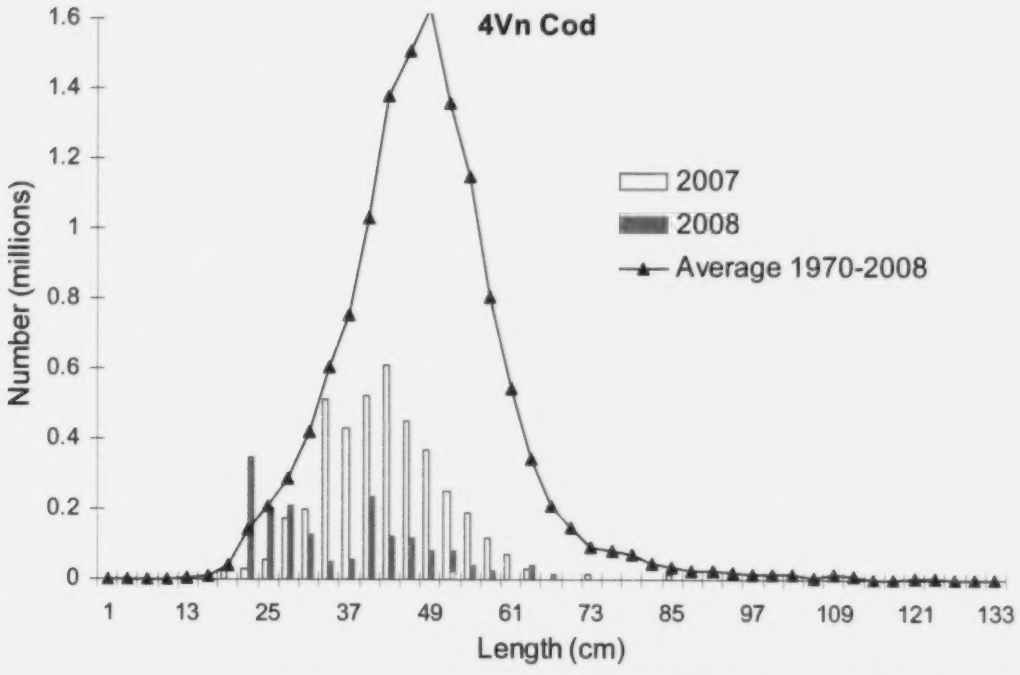

Figure 5c. Length composition for cod in NAFO Subdiv. 4Vn from the Scotia-Fundy summer research vessel survey.

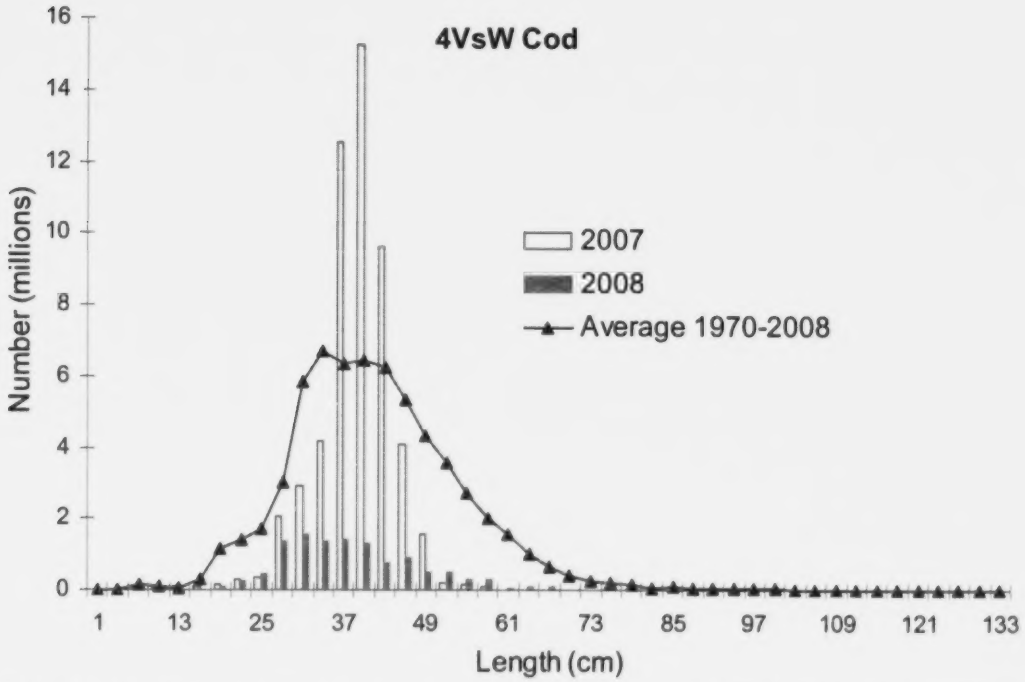

Figure 5d. Length composition for cod in NAFO divs. 4VsW from the Scotia-Fundy summer research vessel survey.

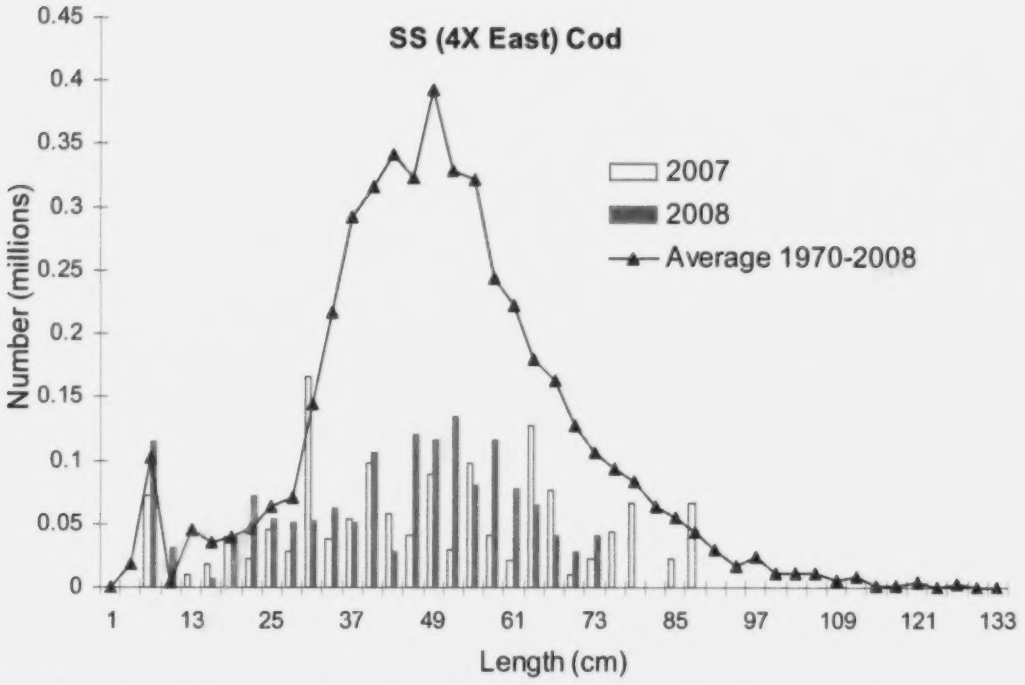

Figure 5e. Length composition for cod in NAFO Div. 4X east from the Scotia-Fundy summer research vessel survey.

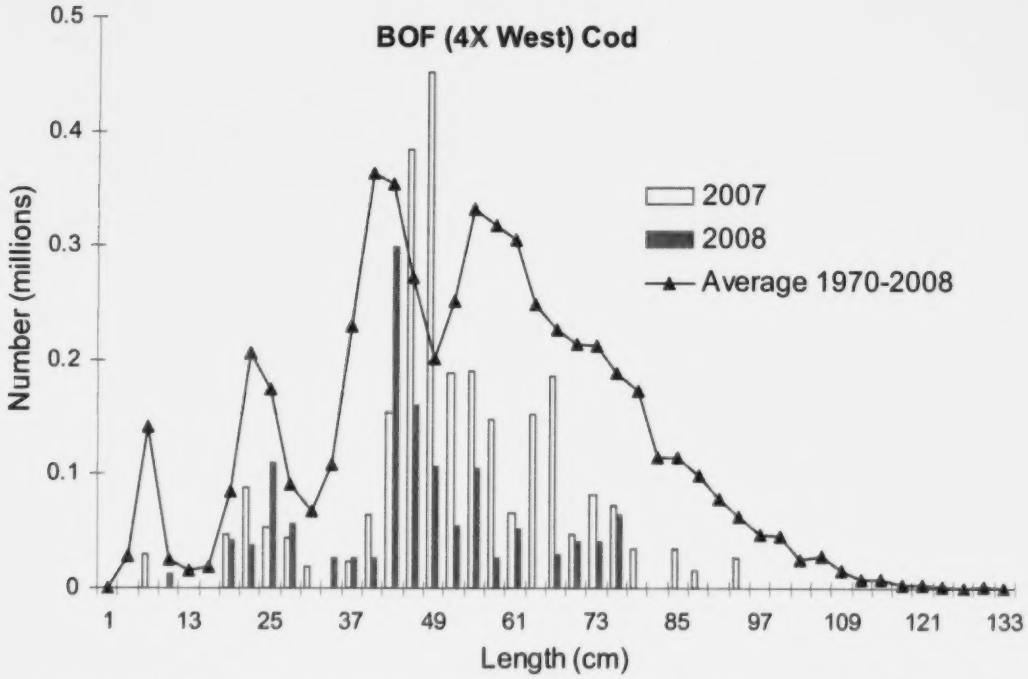

Figure 5f. Length composition for cod in NAFO Div. 4X west from the Scotia-Fundy summer research vessel survey.

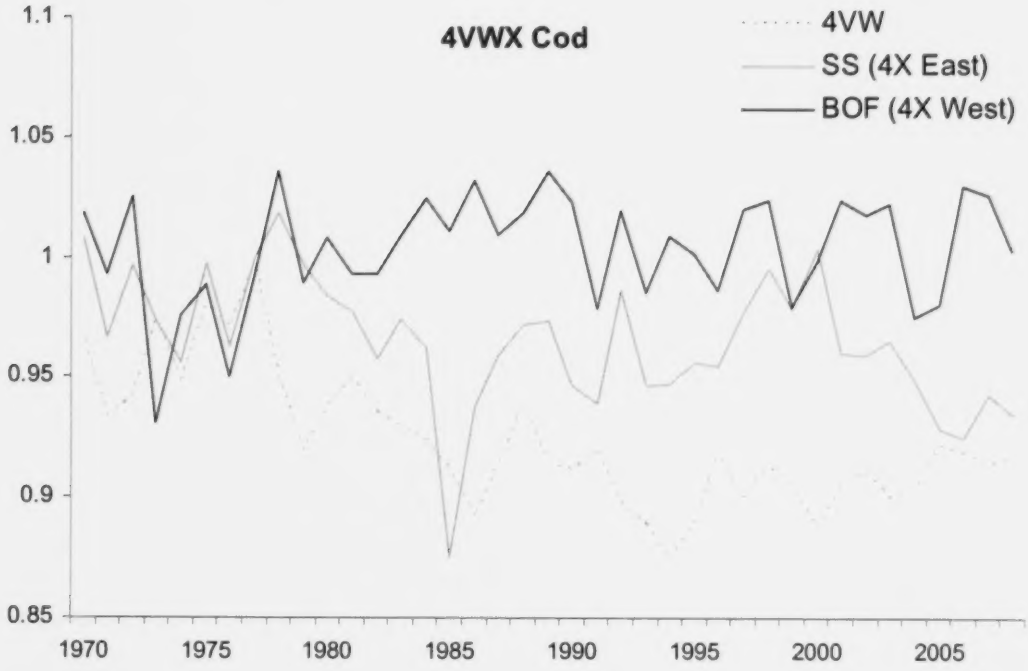

Figure 5g. Condition factor (Fulton's K) for cod from the Scotia-Fundy summer research vessel survey.

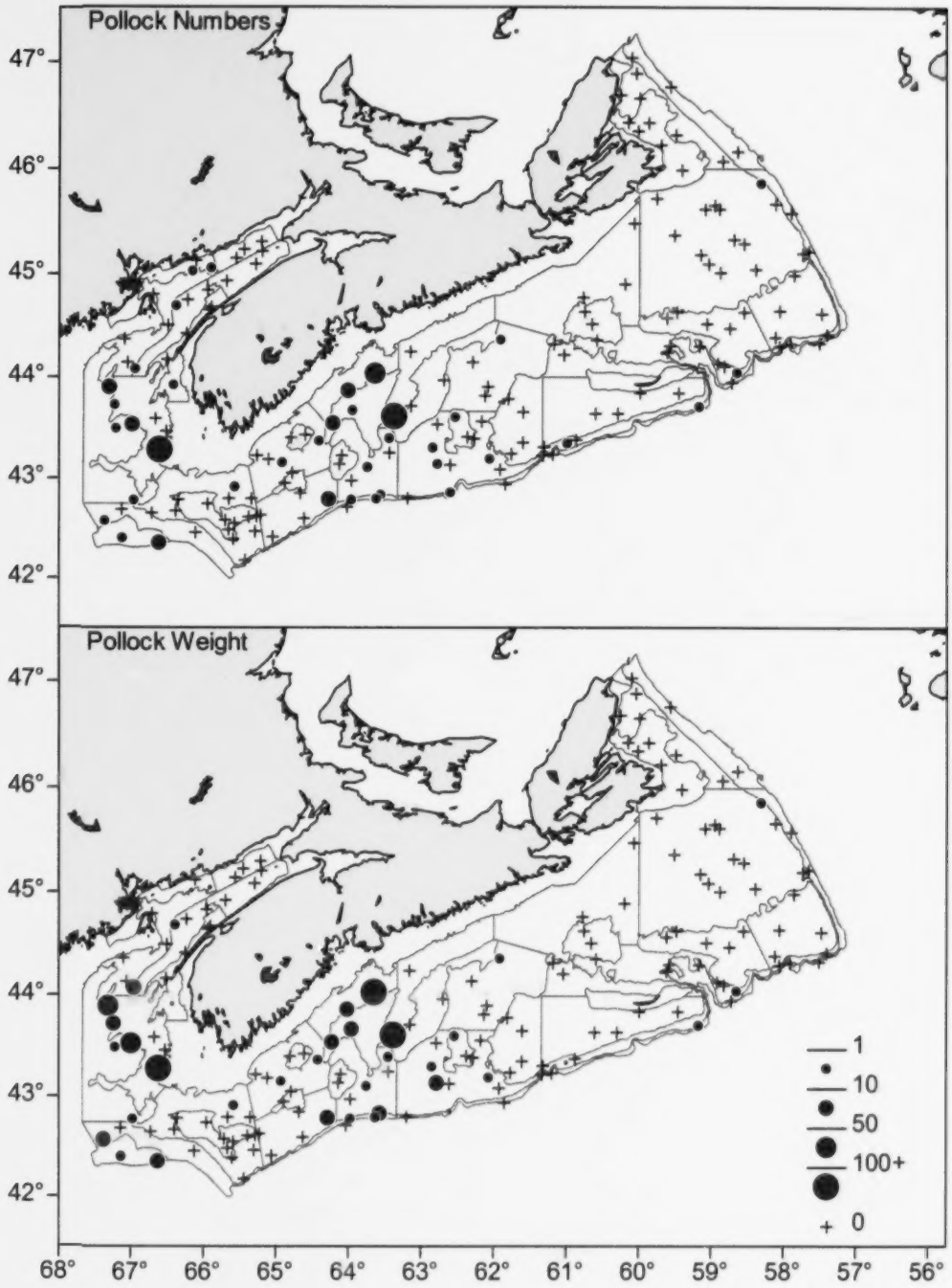

Figure 6a. Distribution of pollock catches during the 2008 Scotia-Fundy summer research vessel survey.

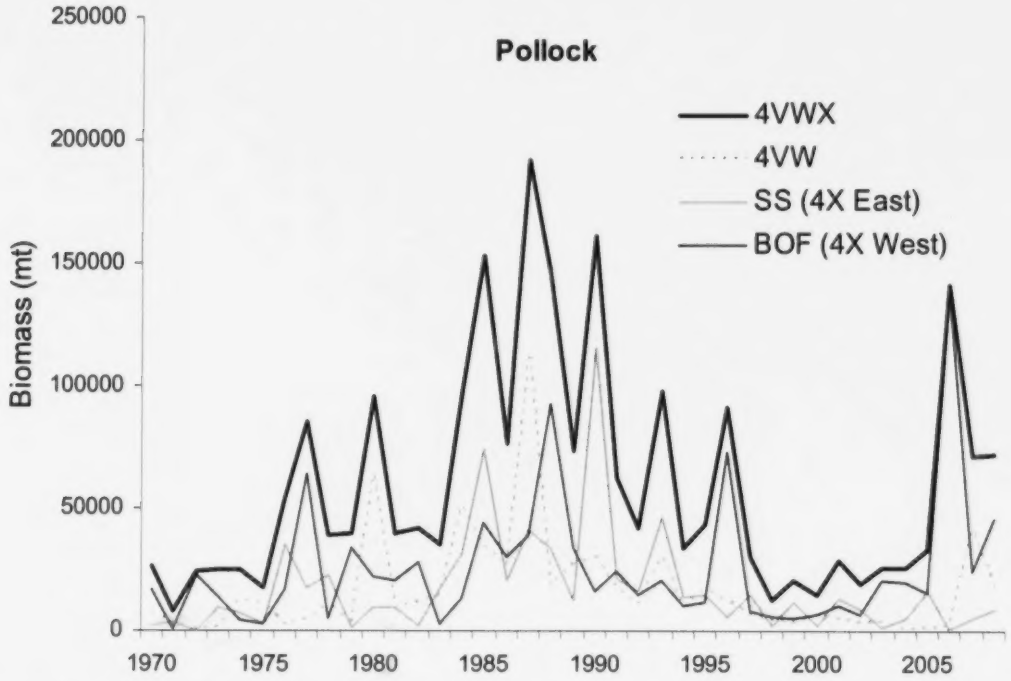

Figure 6b. Biomass estimate for pollock from the Scotia-Fundy summer research vessel survey.

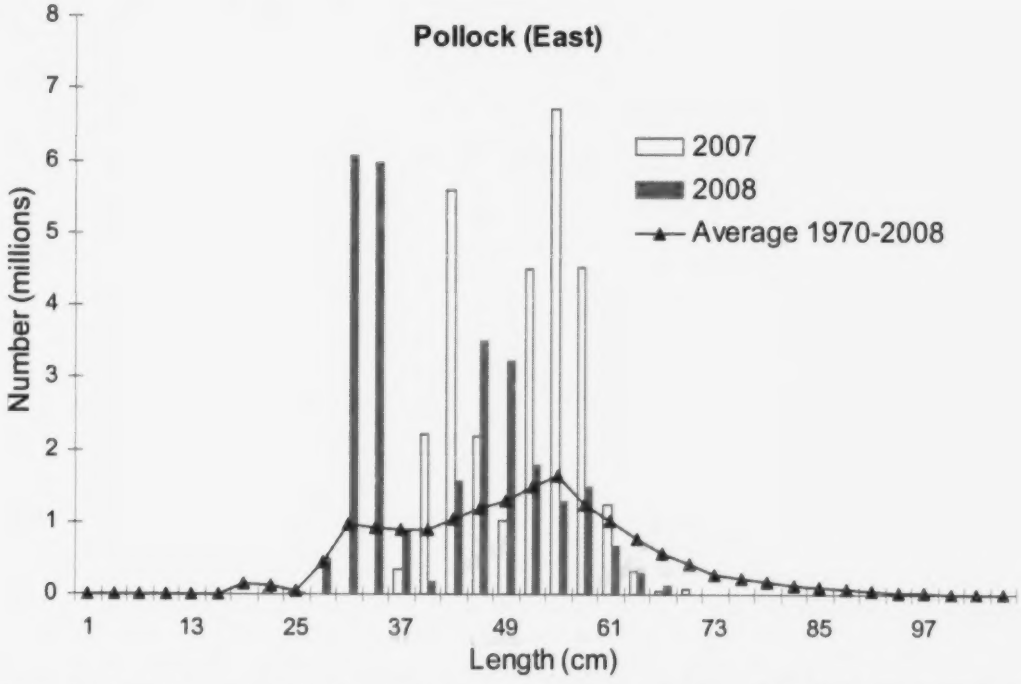

Figure 6c. Length composition for pollock eastern component from the Scotia-Fundy summer research vessel survey.

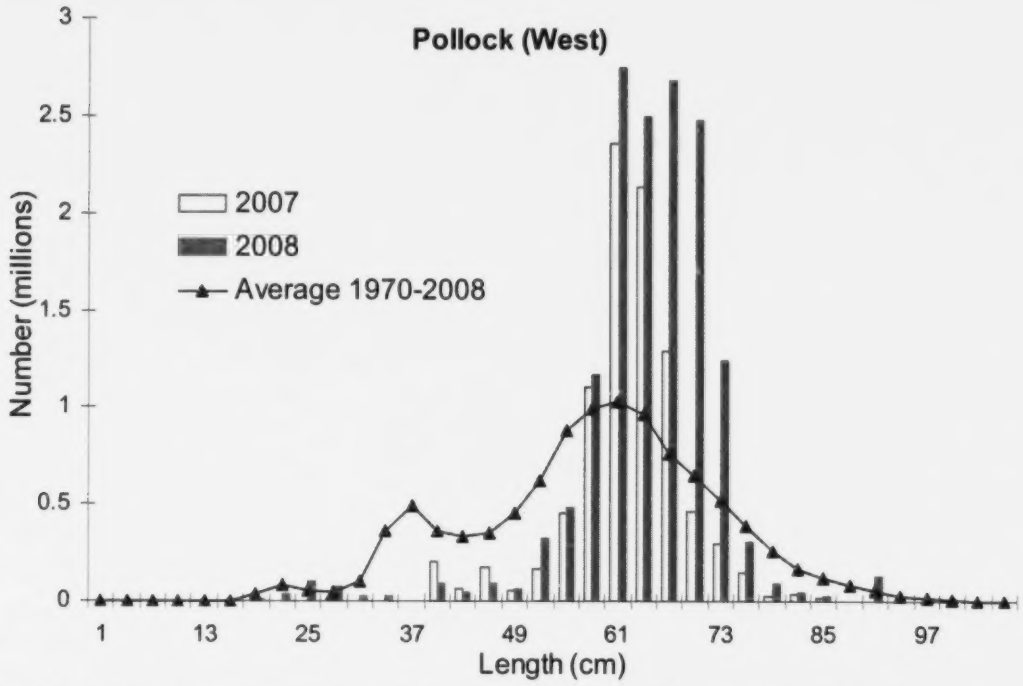

Figure 6d. Length composition for pollock western component from the Scotia-Fundy summer research vessel survey.

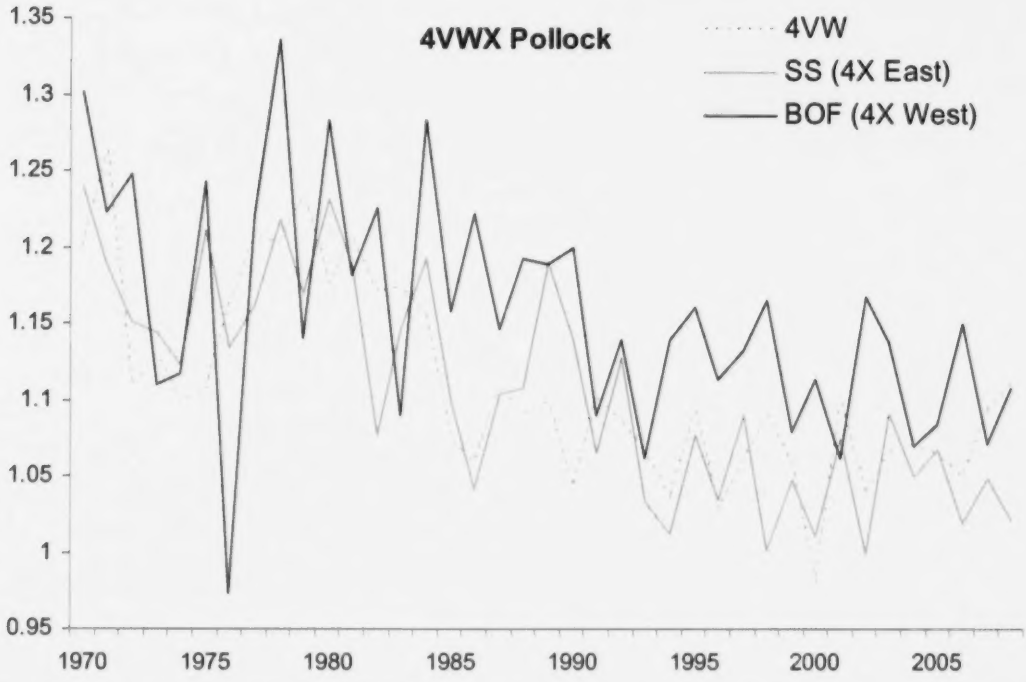

Figure 6e. Condition factor (Fulton's K) for pollock from the Scotia-Fundy summer research vessel survey.

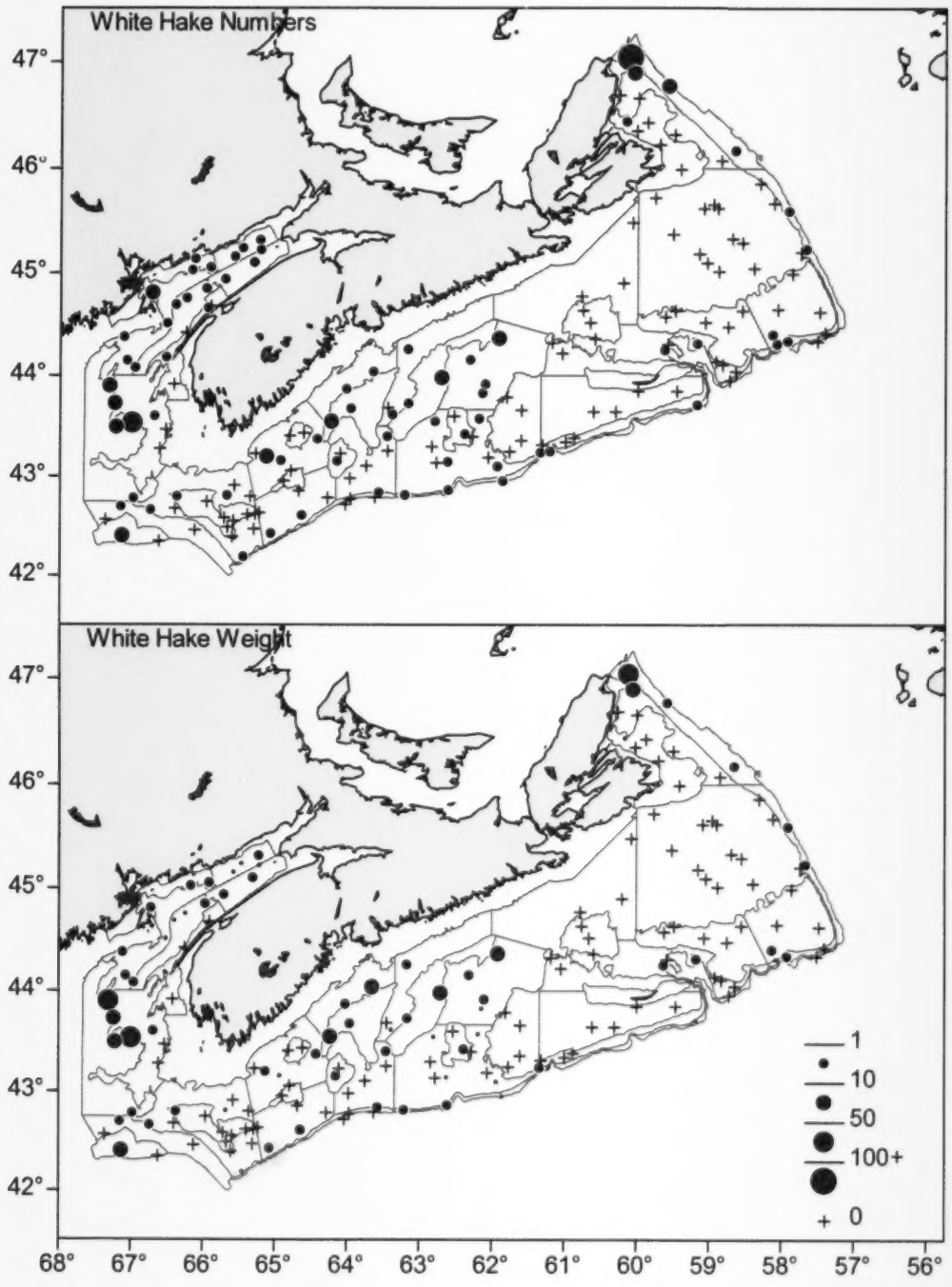

Figure 7a. Distribution of white hake catches during the 2008 Scotia-Fundy summer research vessel survey.

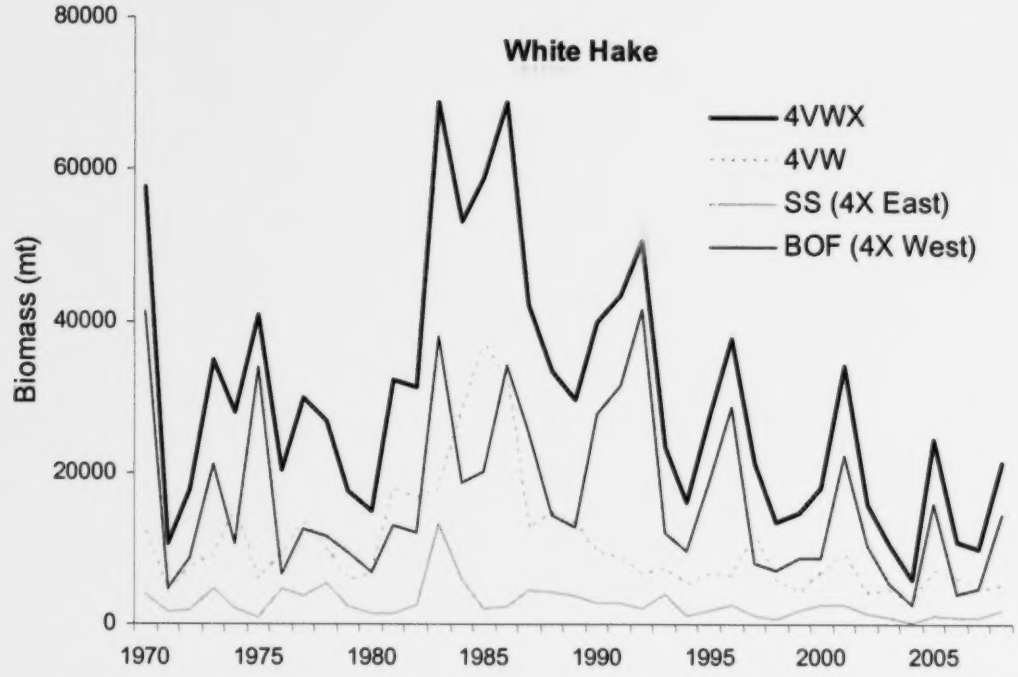

Figure 7b. Biomass estimate for white hake from the Scotia-Fundy summer research vessel survey.

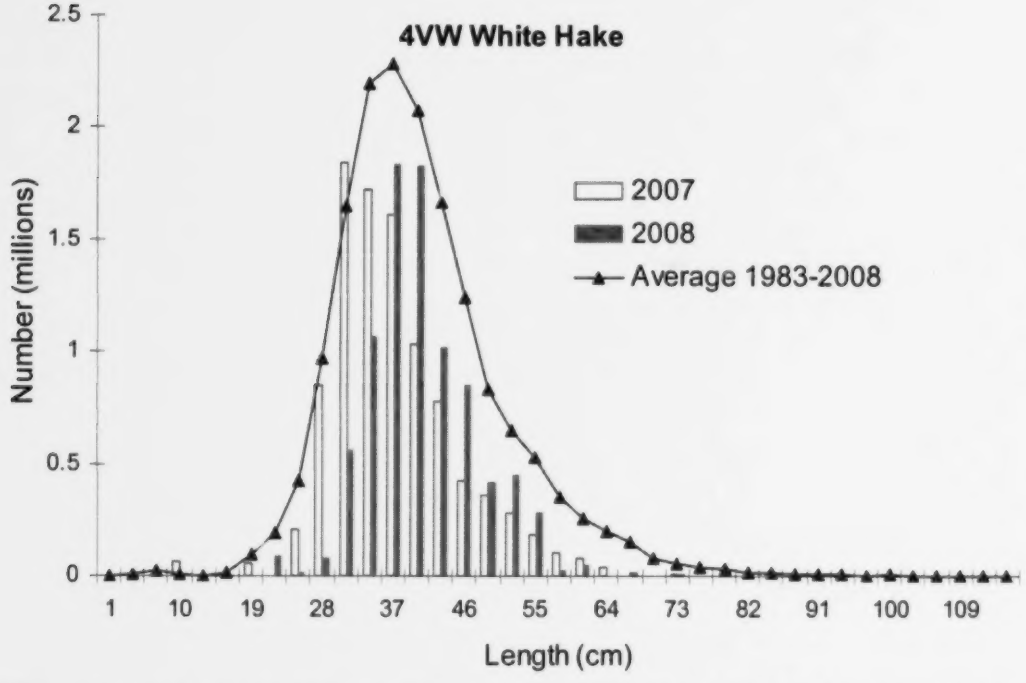

Figure 7c. Length composition for white hake in NAFO divs. 4VW from the Scotia-Fundy summer research vessel survey.

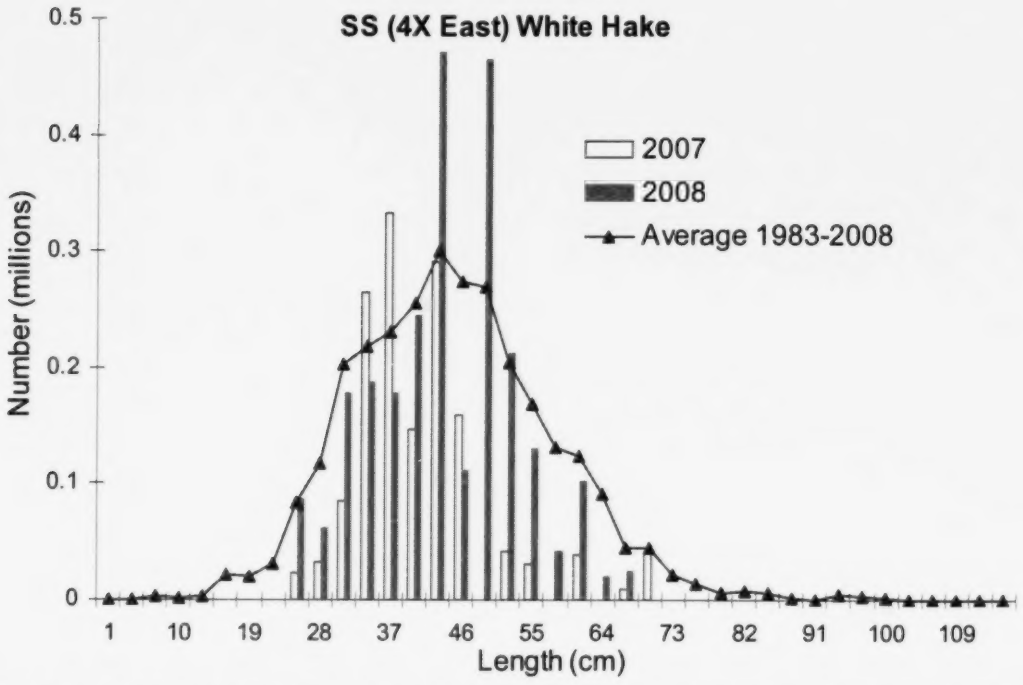

Figure 7d. Length composition for white hake in NAFO Div. 4X east from the Scotia-Fundy summer research vessel survey.

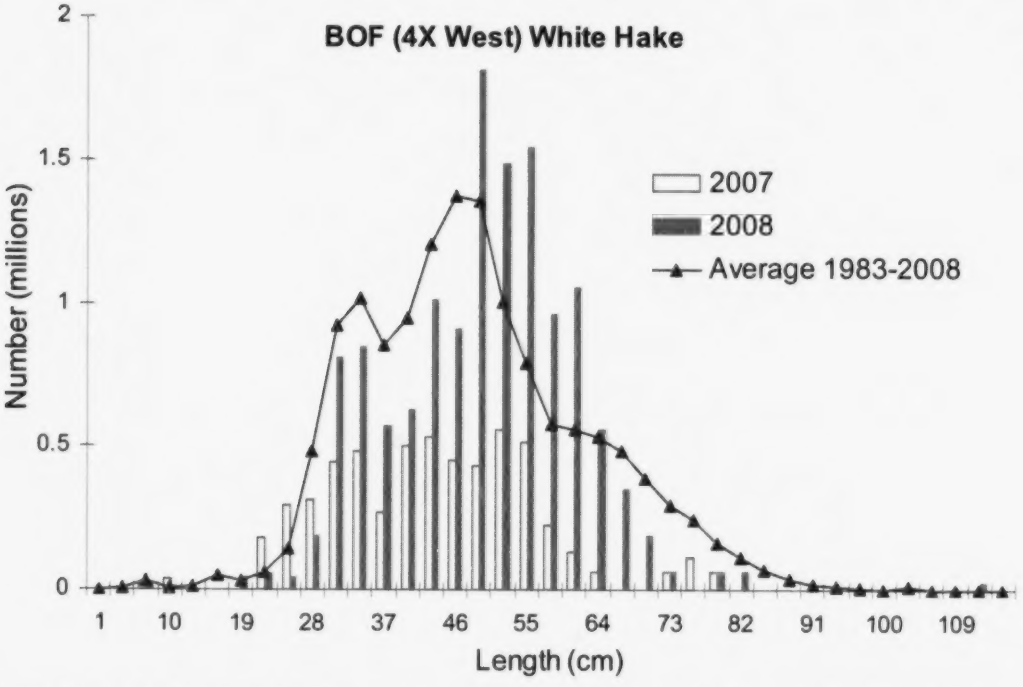

Figure 7e. Length composition for white hake in NAFO Div. 4X west from the Scotia-Fundy summer research vessel survey.

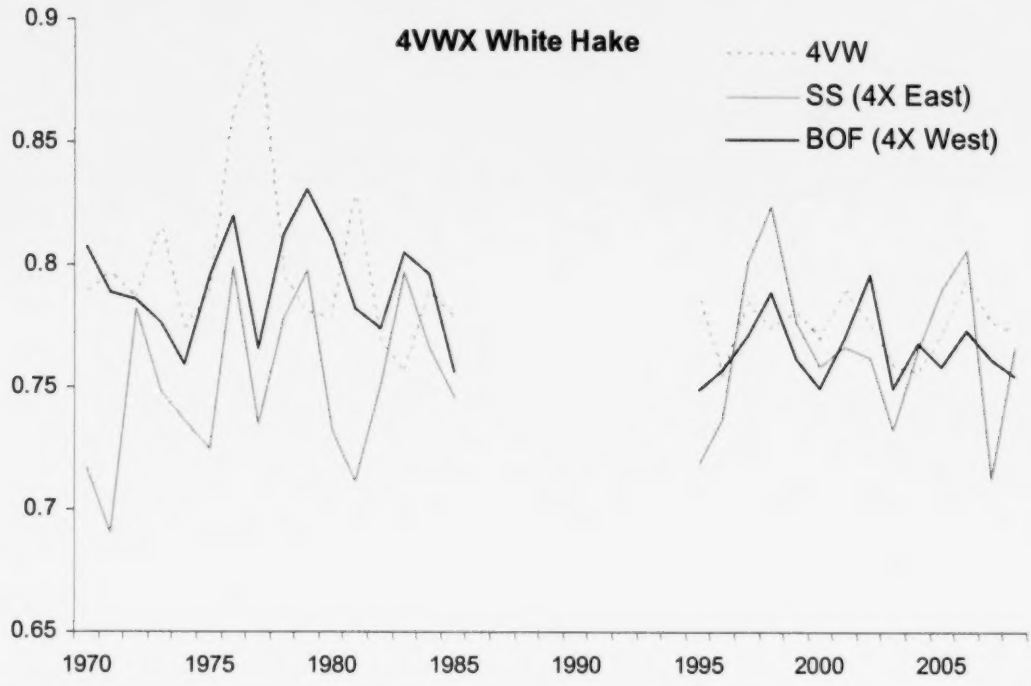

Figure 7f. Condition factor (Fulton's K) for white hake from the Scotia-Fundy summer research vessel survey.

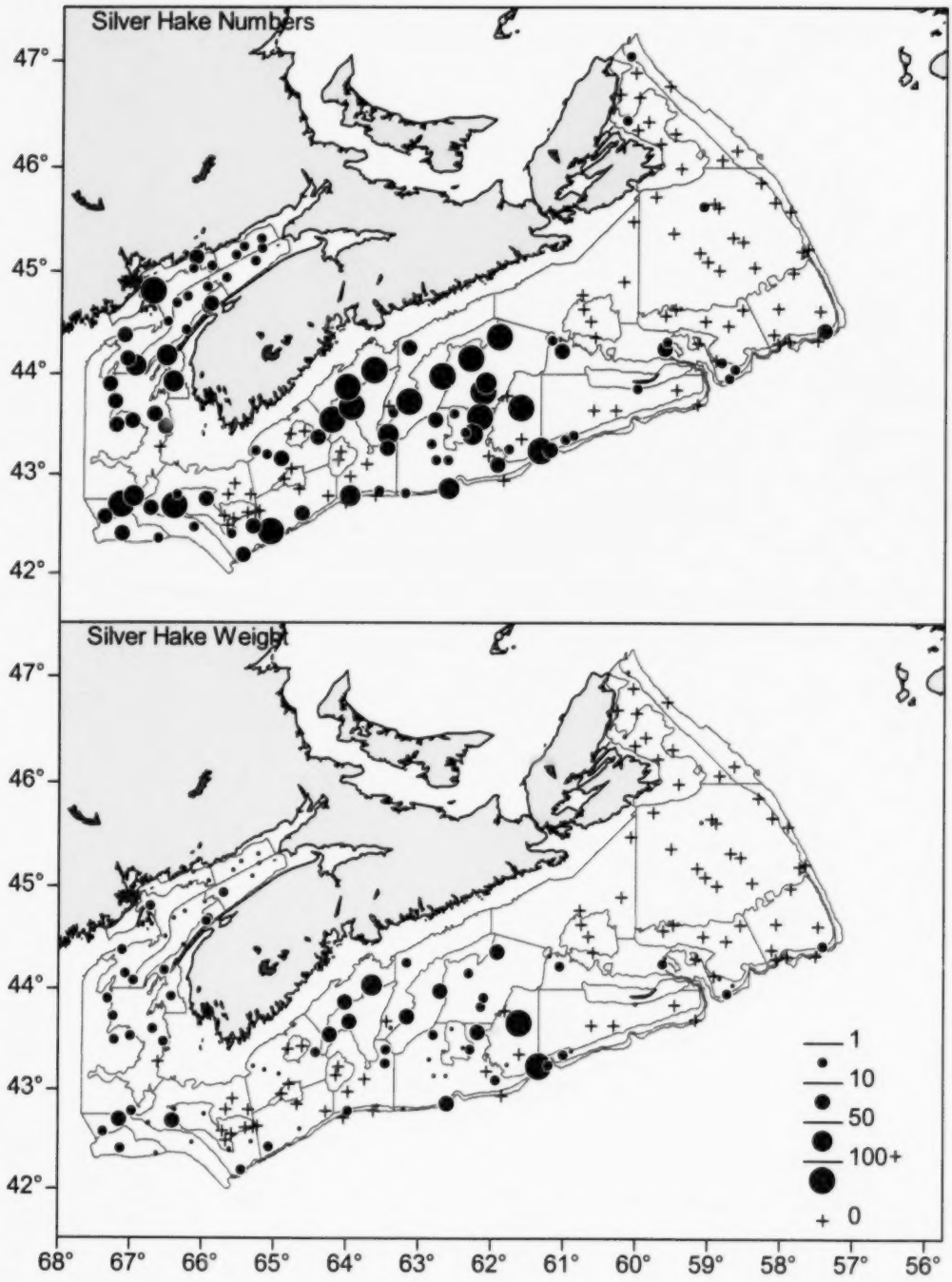

Figure 8a. Distribution of silver hake catches during the 2008 Scotia-Fundy summer research vessel survey.

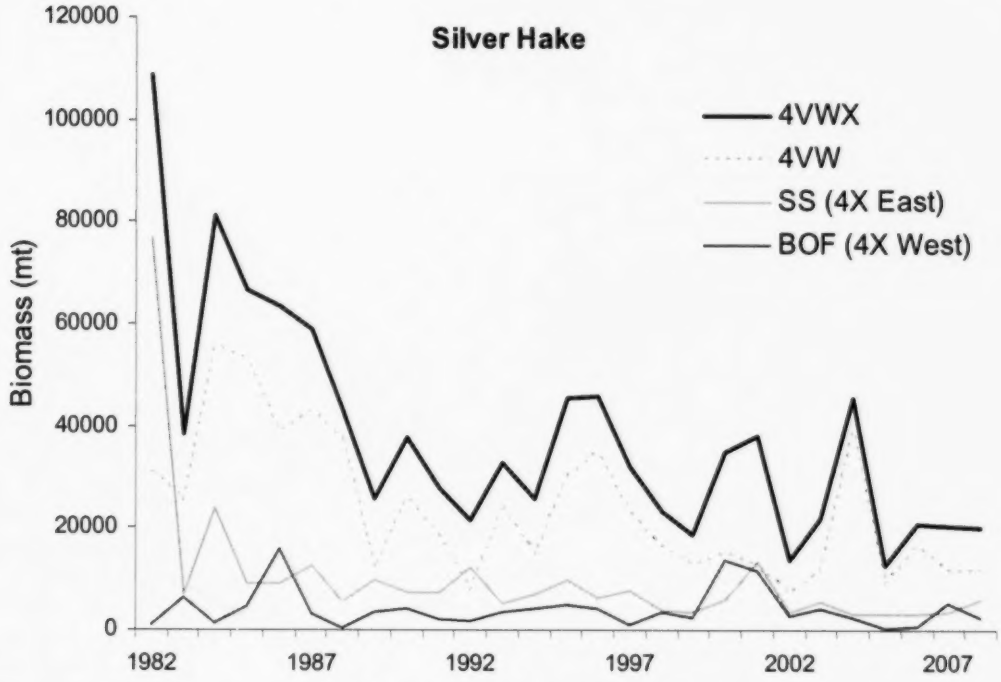

Figure 8b. Biomass estimate for silver hake from the Scotia-Fundy summer research vessel survey.

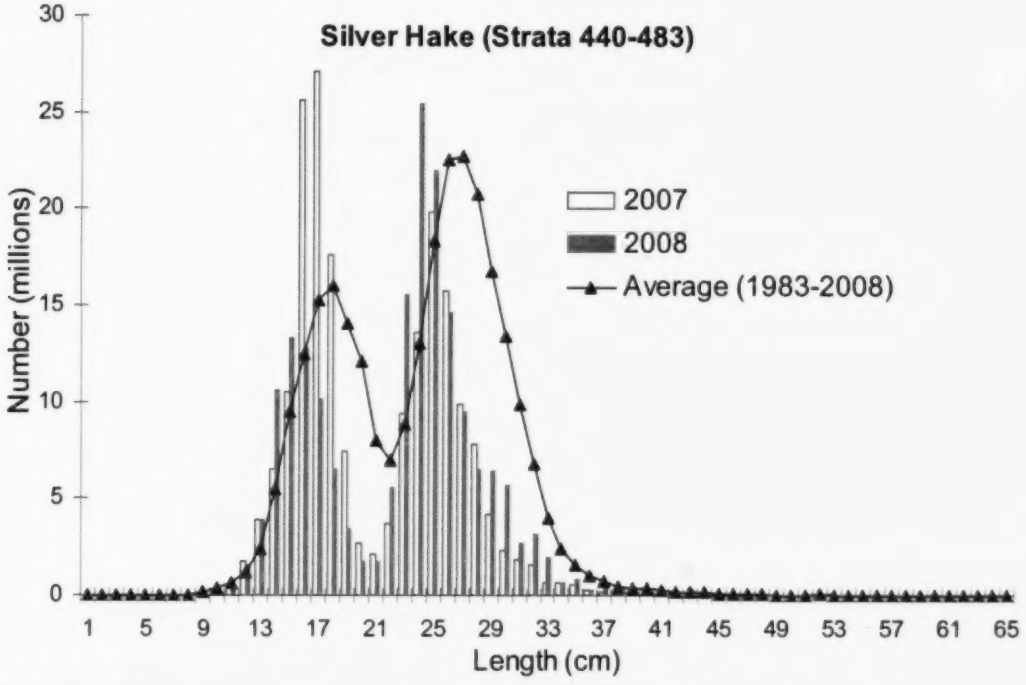

Figure 8c. Length composition for silver hake in strata 440-483 from the Scotia-Fundy summer research vessel survey.

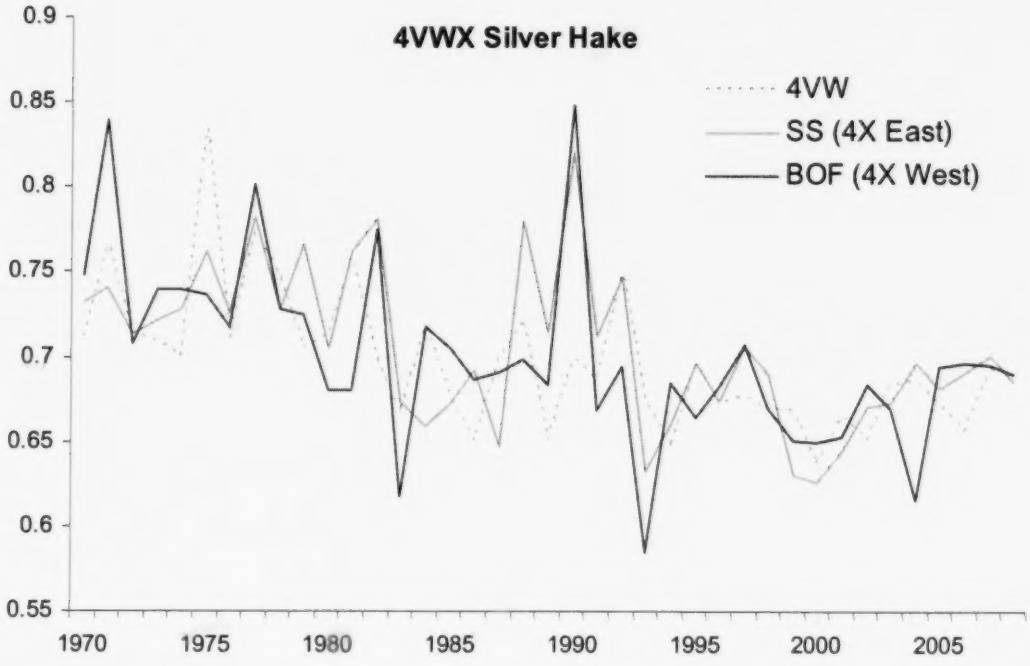

Figure 8d. Condition factor (Fulton's K) for silver hake from the Scotia-Fundy summer research vessel survey.

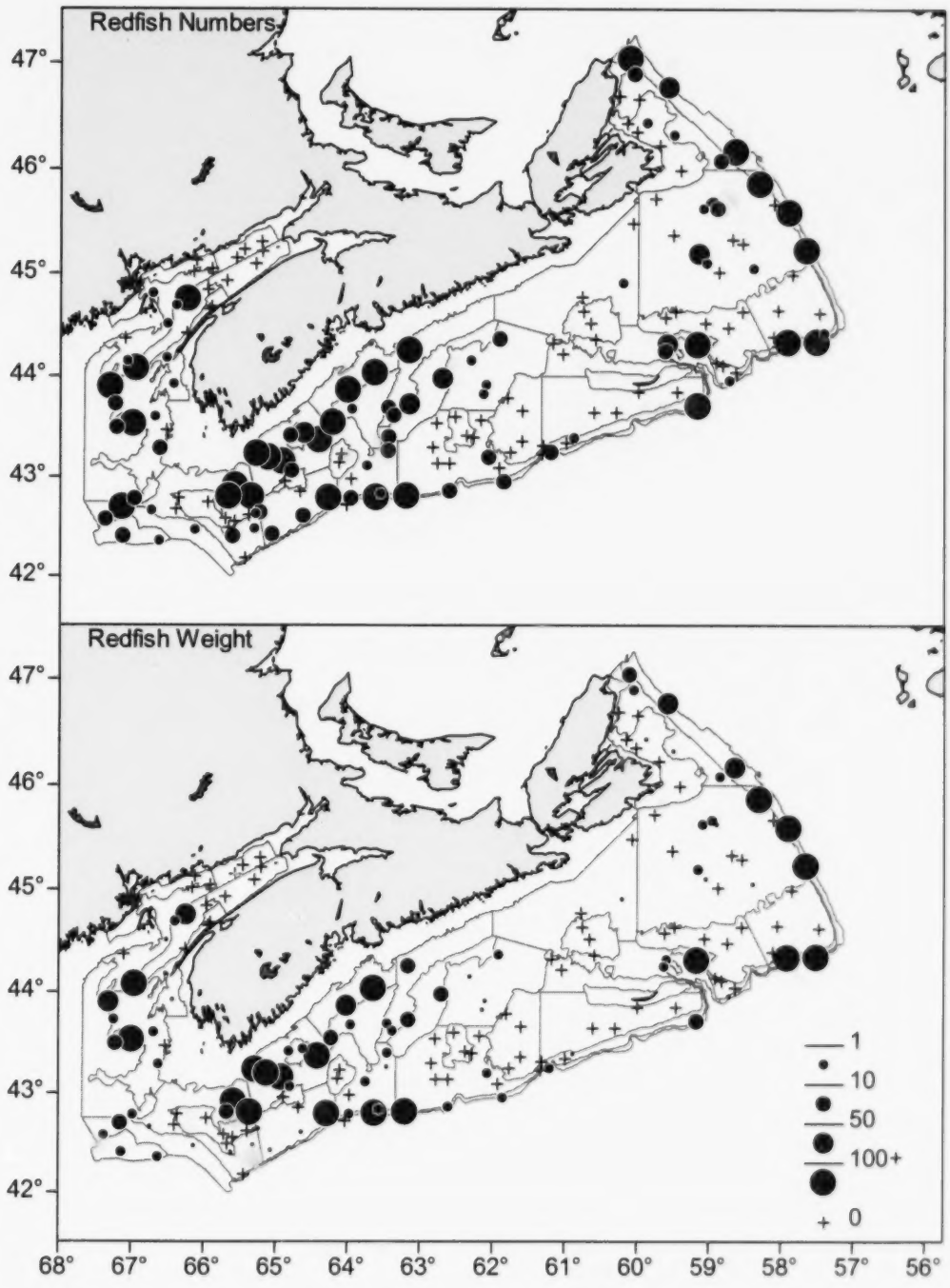

Figure 9a. Distribution of redfish catches during the 2008 Scotia-Fundy summer research vessel survey.

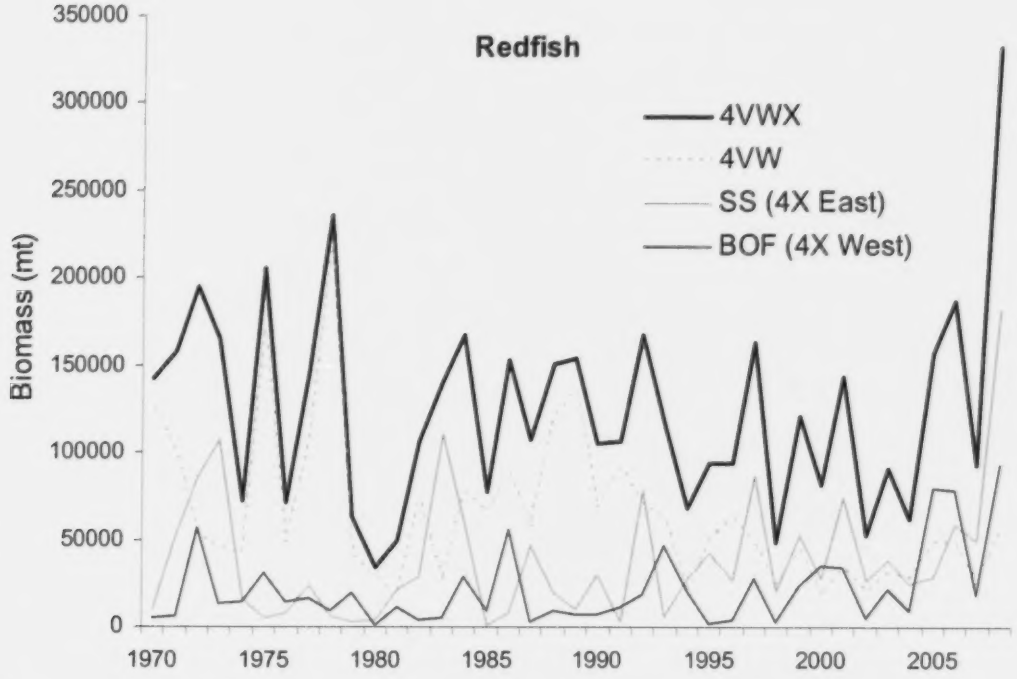

Figure 9b. Biomass estimate for redfish from the Scotia-Fundy summer research vessel survey.

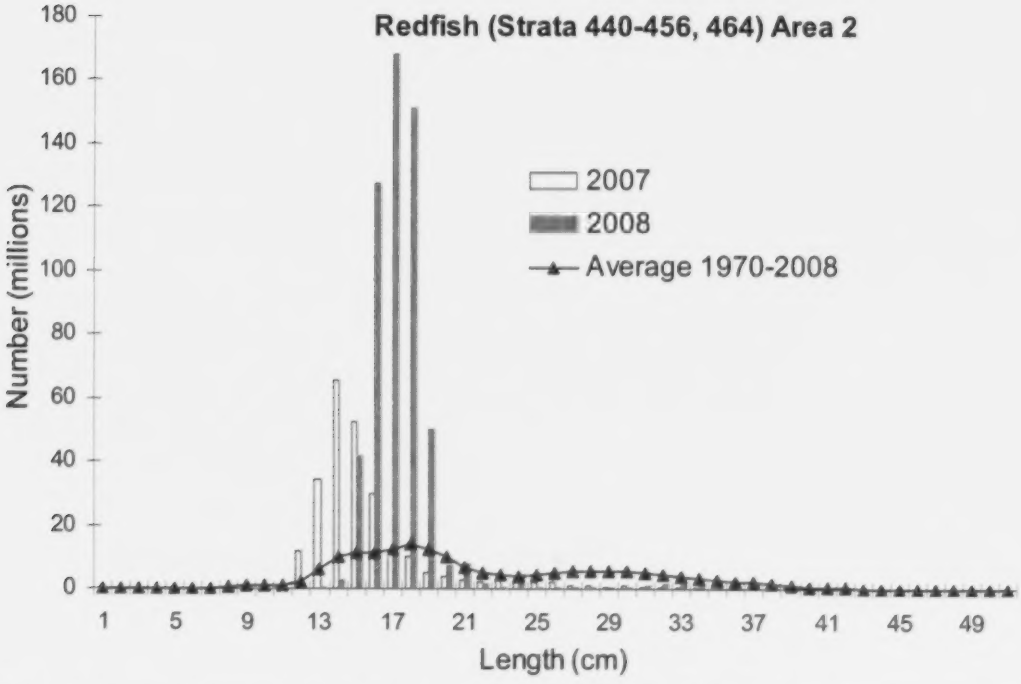

Figure 9c. Length composition of redfish in Area 2 from the Scotia-Fundy summer research vessel survey.

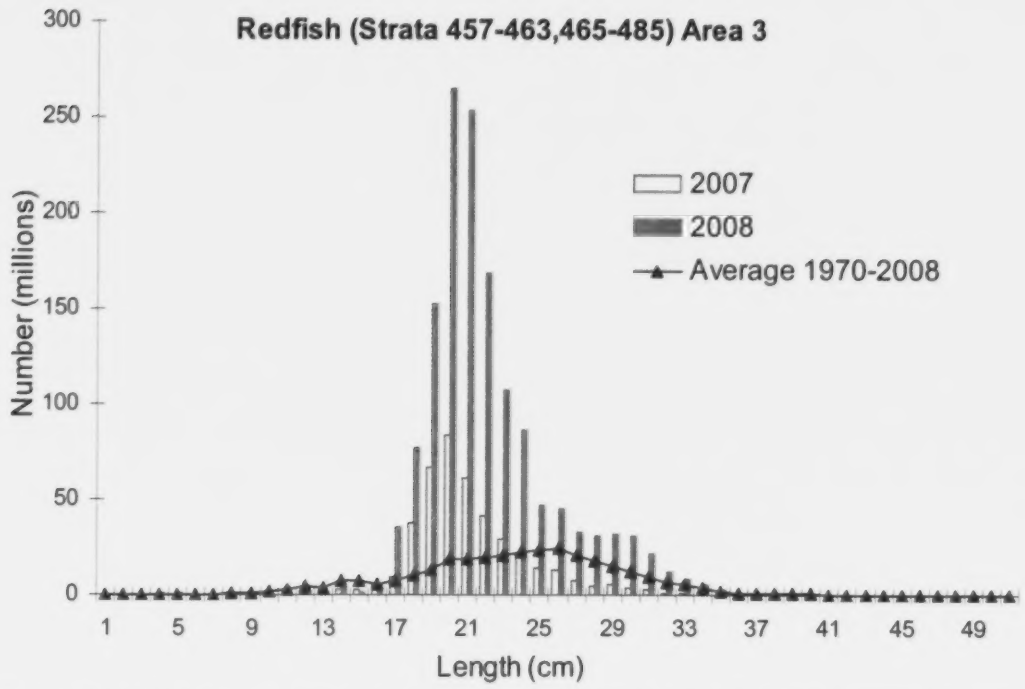

Figure 9d. Length composition of redfish in Area 3 from the Scotia-Fundy summer research vessel survey.

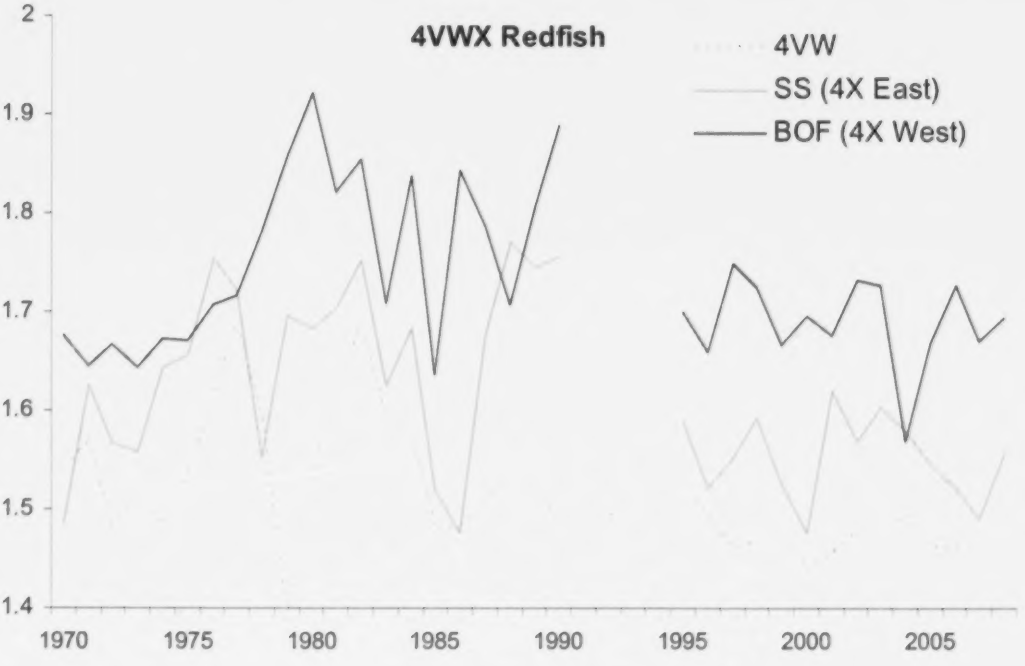

Figure 9e. Condition factor (Fulton's K) for redfish from the Scotia-Fundy summer research vessel survey.

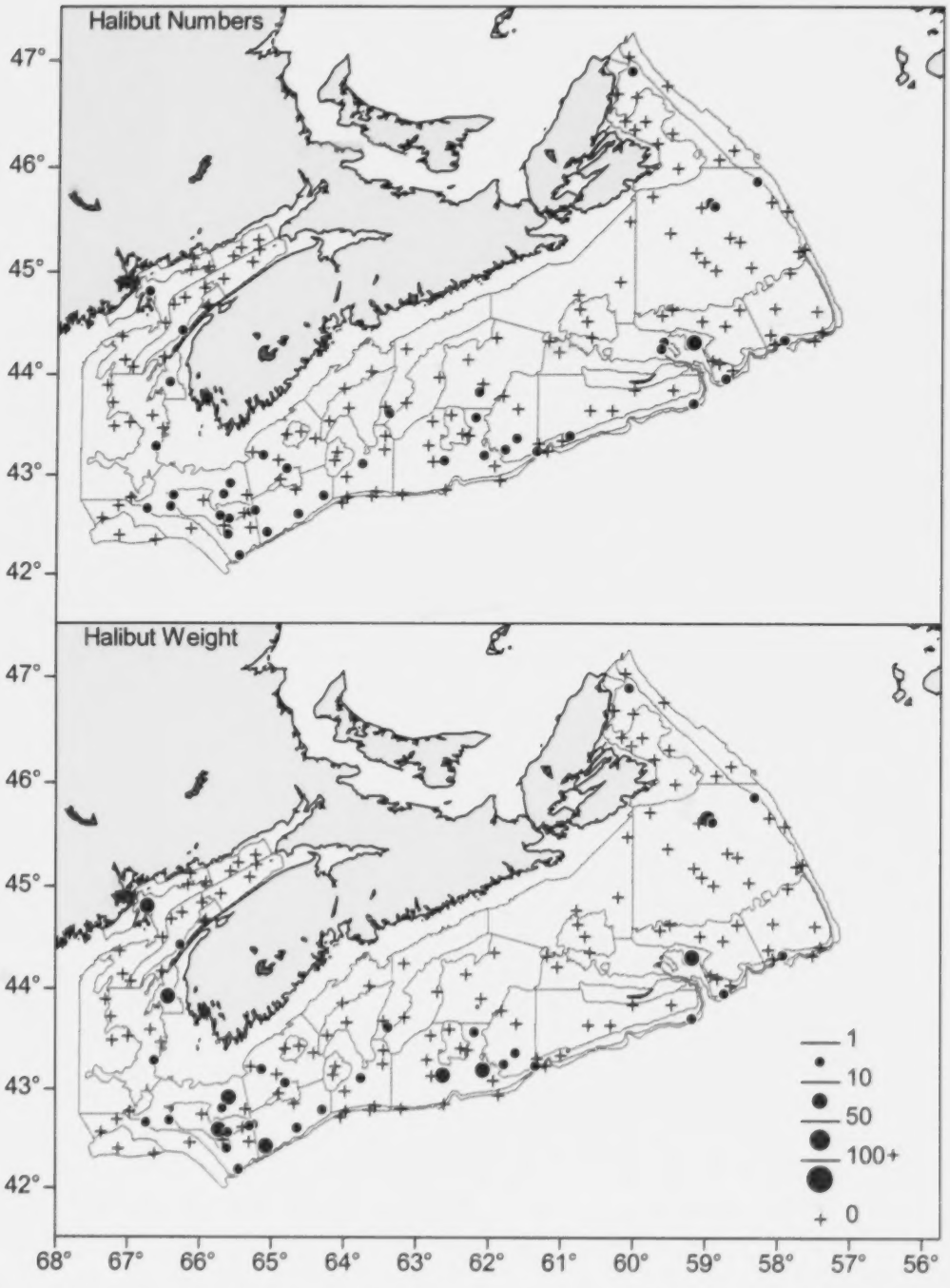

Figure 10a. Distribution of Atlantic halibut catches during the 2008 Scotia-Fundy summer research vessel survey

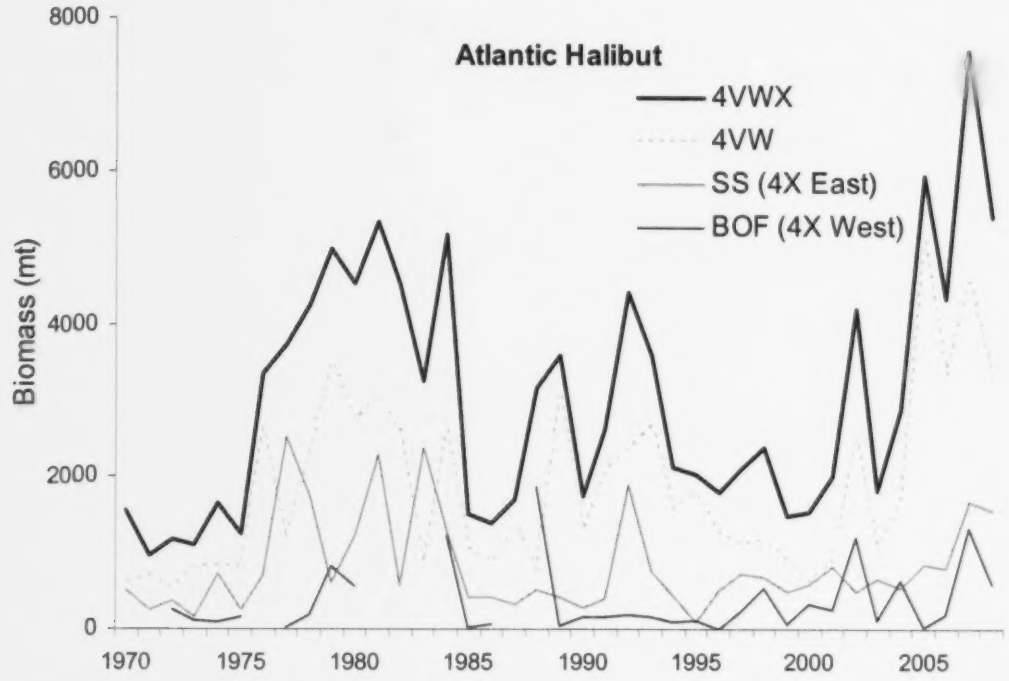

Figure 10b. Biomass estimate for Atlantic halibut from the Scotia-Fundy summer research vessel survey.

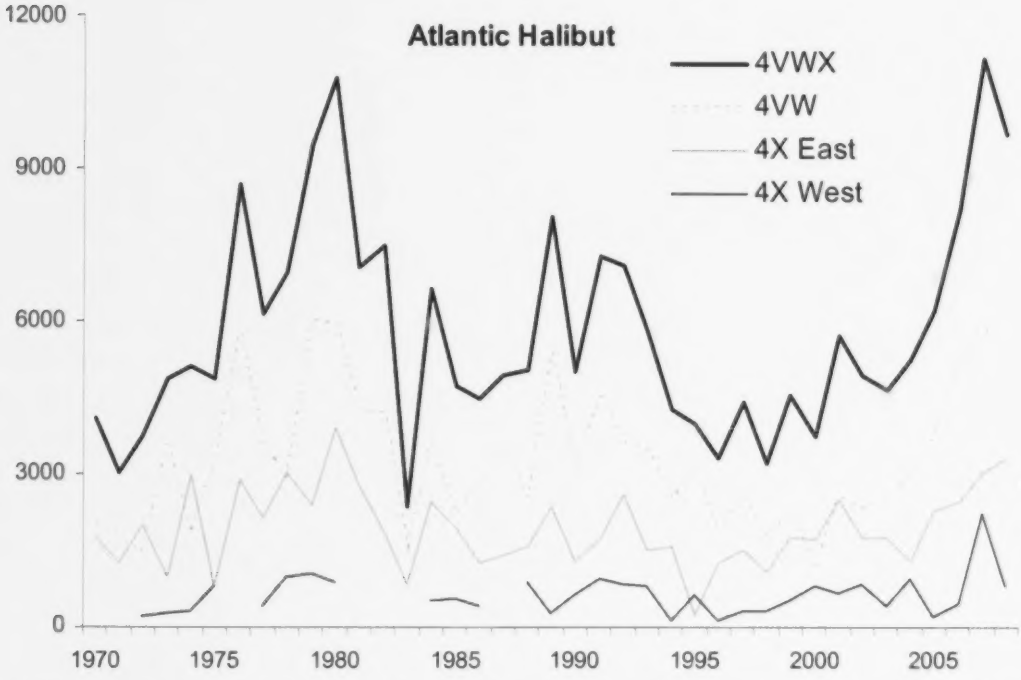

Figure 10c. Area occupied for Atlantic halibut from the Scotia-Fundy summer research vessel survey.

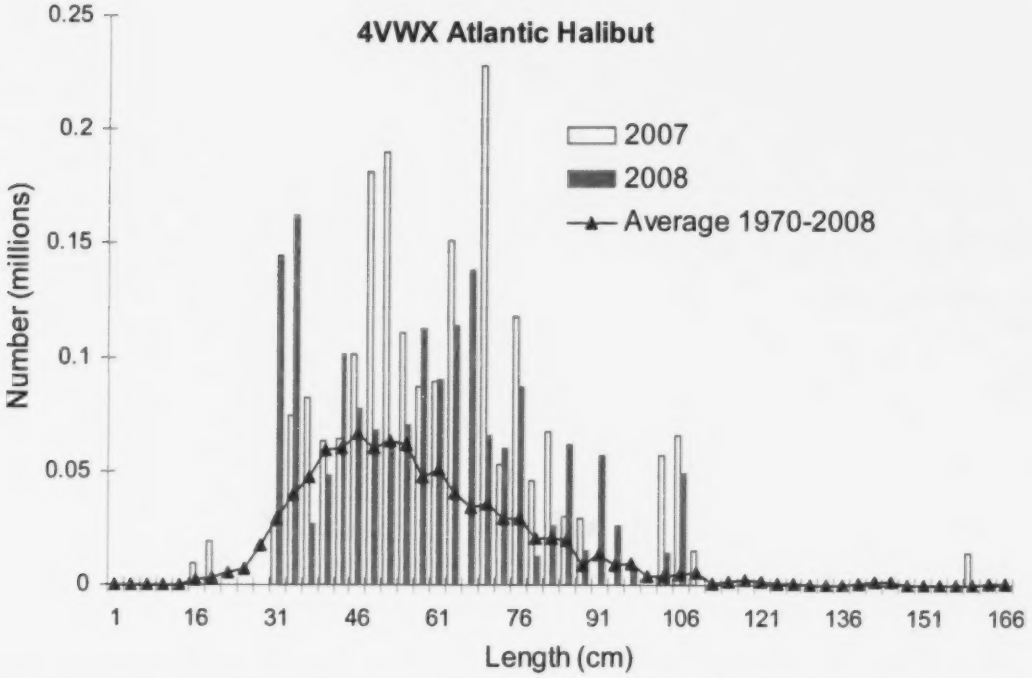

Figure 10d. Length composition for Atlantic halibut in NAFO divs. 4VWX from the Scotia-Fundy summer research vessel survey.

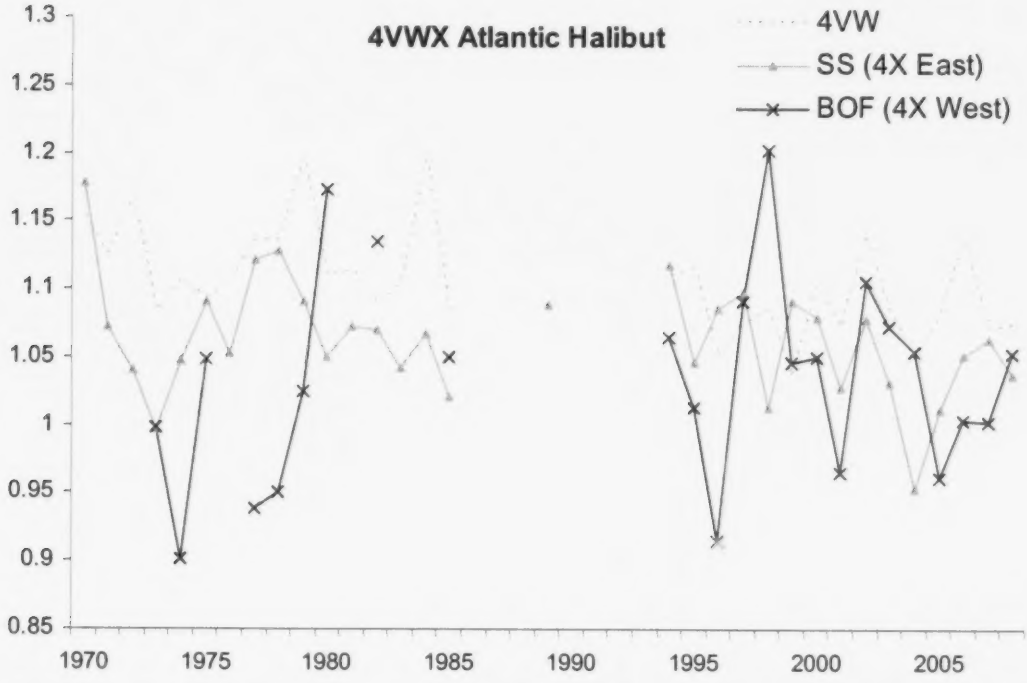

Figure 10e. Condition factor (Fulton's K) for Atlantic halibut from the Scotia-Fundy summer research vessel survey.

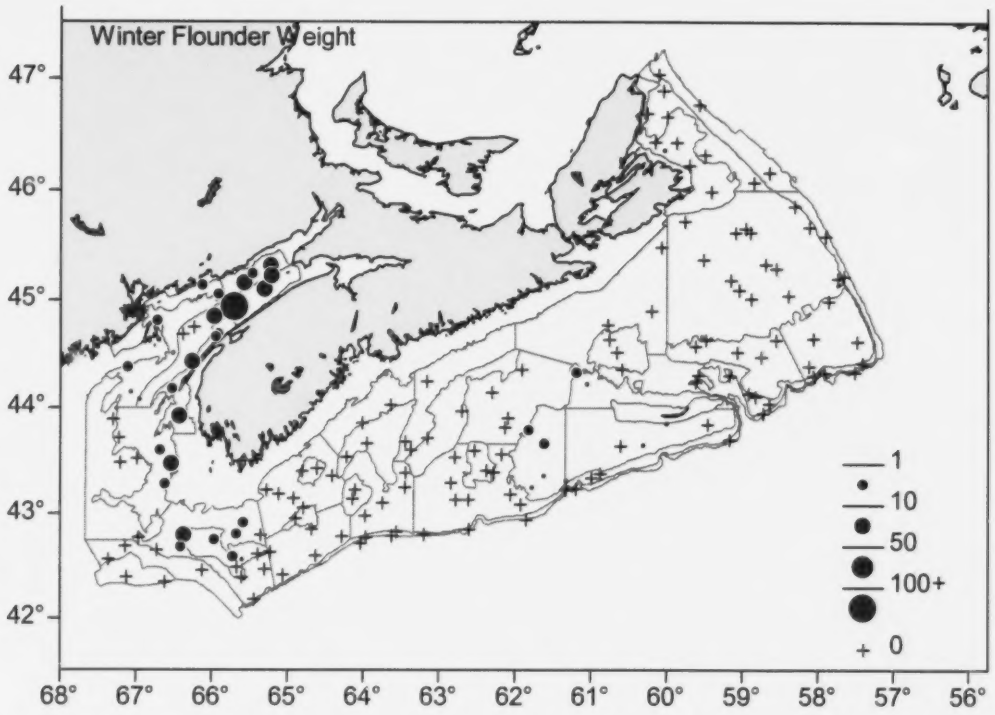

Figure 11a. Distribution of winter flounder catch during the 2008 Scotia-Fundy summer research vessel survey.

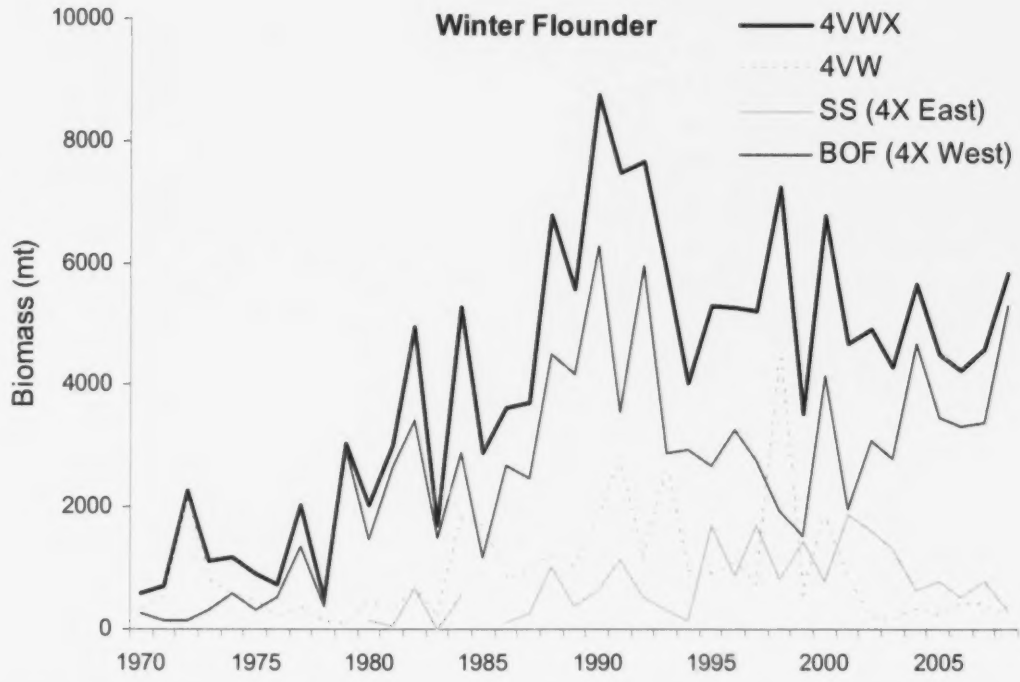

Figure 11b. Biomass estimate for winter flounder from the Scotia-Fundy summer research vessel survey.

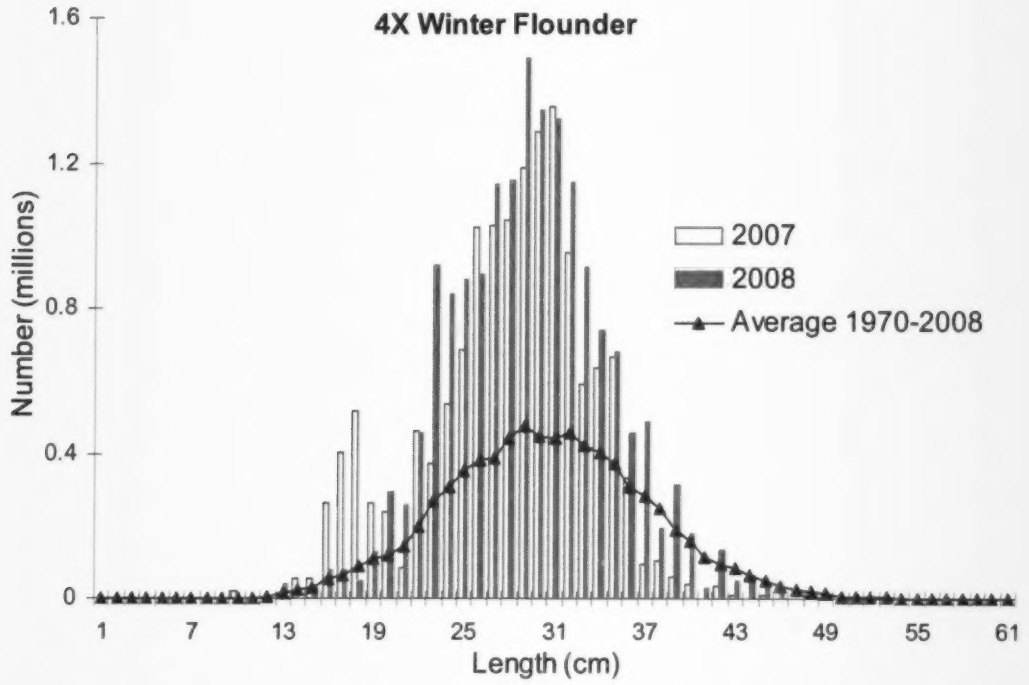

Figure 11c. Length composition for winter flounder in NAFO Div. 4X from the Scotia-Fundy summer research vessel survey.

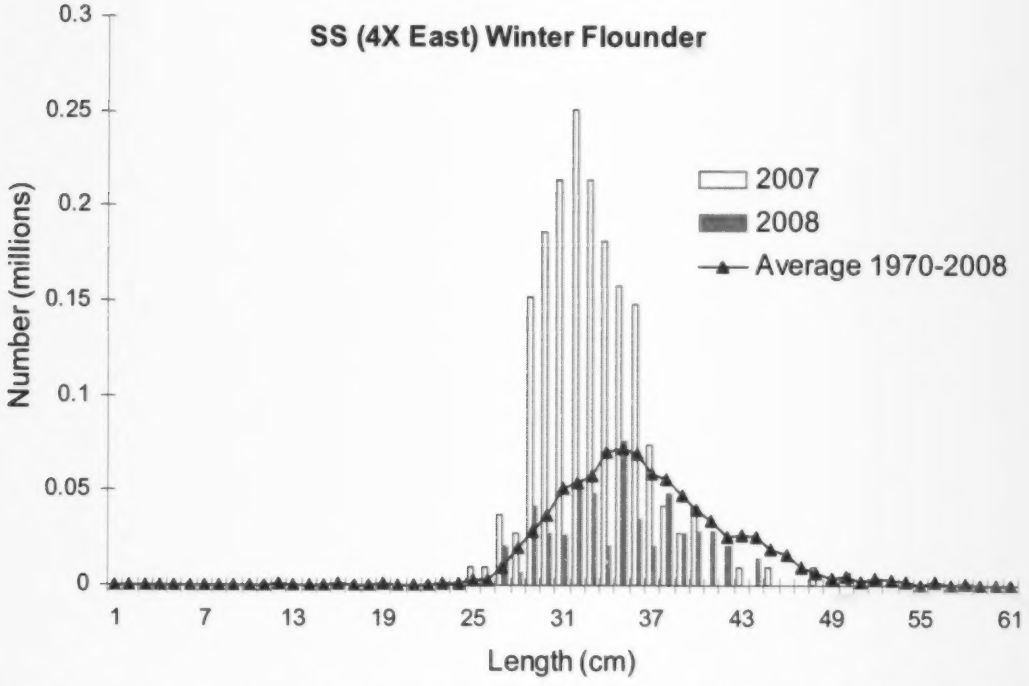

Figure 11d. Length composition for winter flounder in NAFO Div. 4X east from the Scotia-Fundy summer research vessel survey.

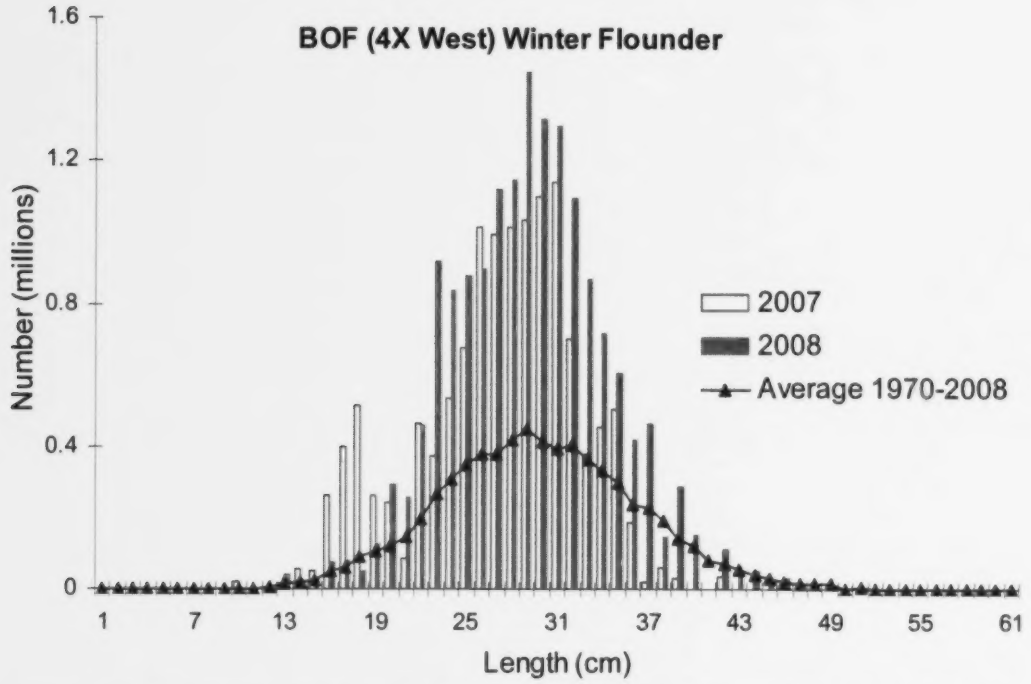

Figure 11e. Length composition for winter flounder in NAFO Div. 4X west from the Scotia-Fundy summer research vessel survey.

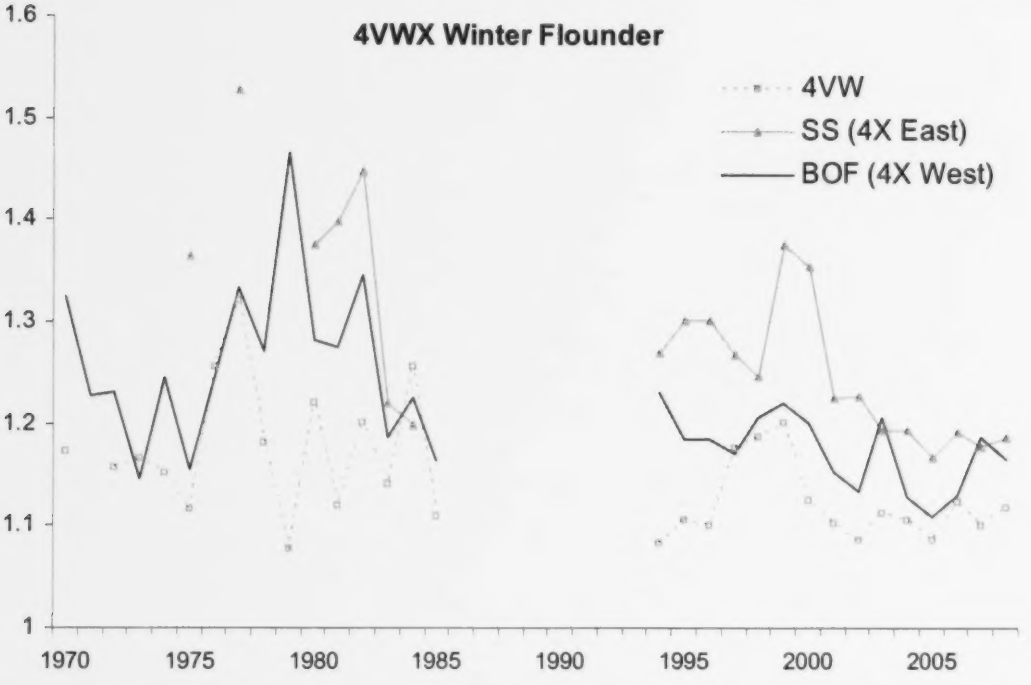

Figure 11f. Condition factor (Fulton's K) for winter flounder from the Scotia-Fundy summer research vessel survey.

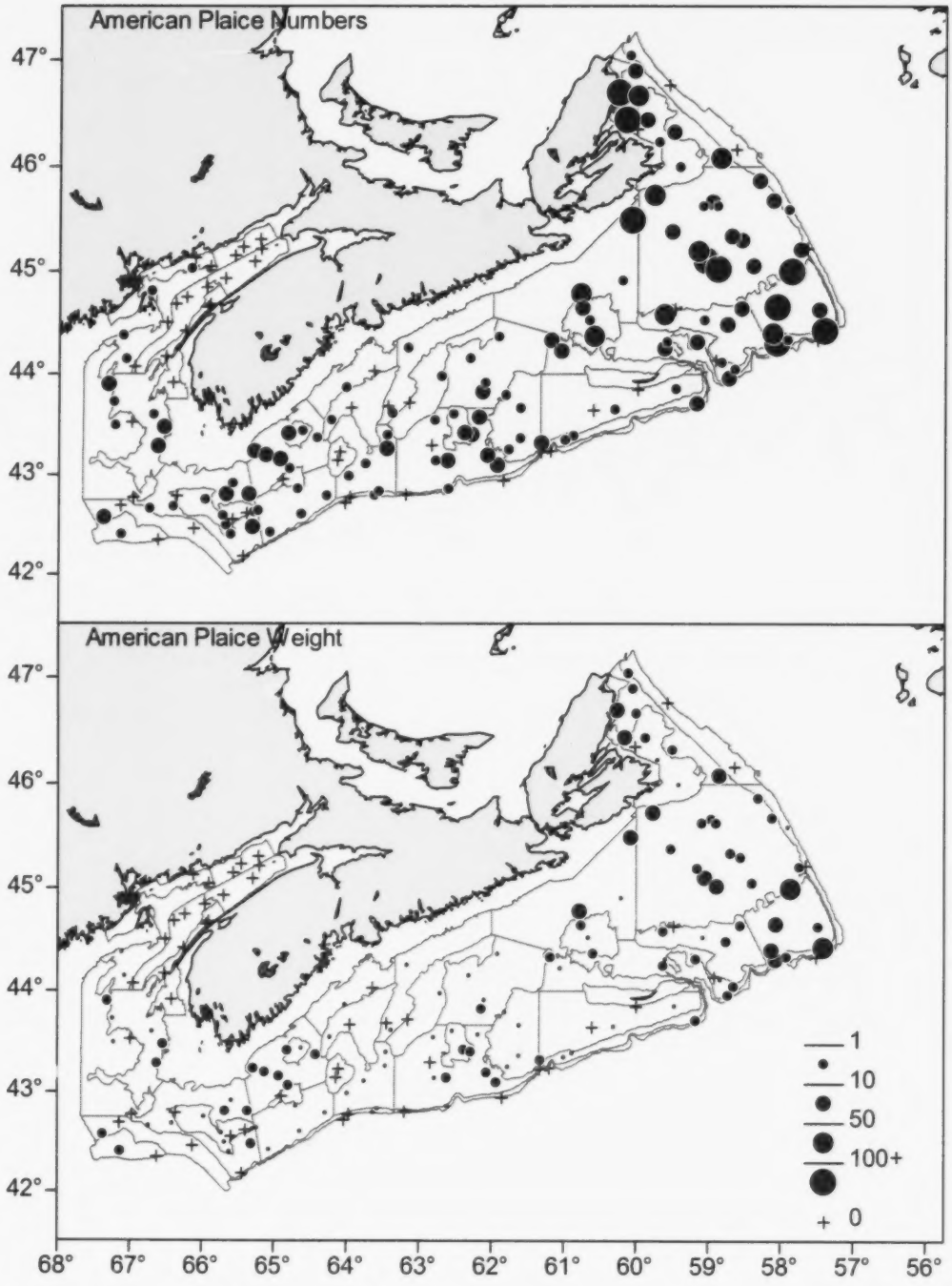

Figure 12a. Distribution of American plaice catches during the 2008 Scotia-Fundy summer research vessel survey.

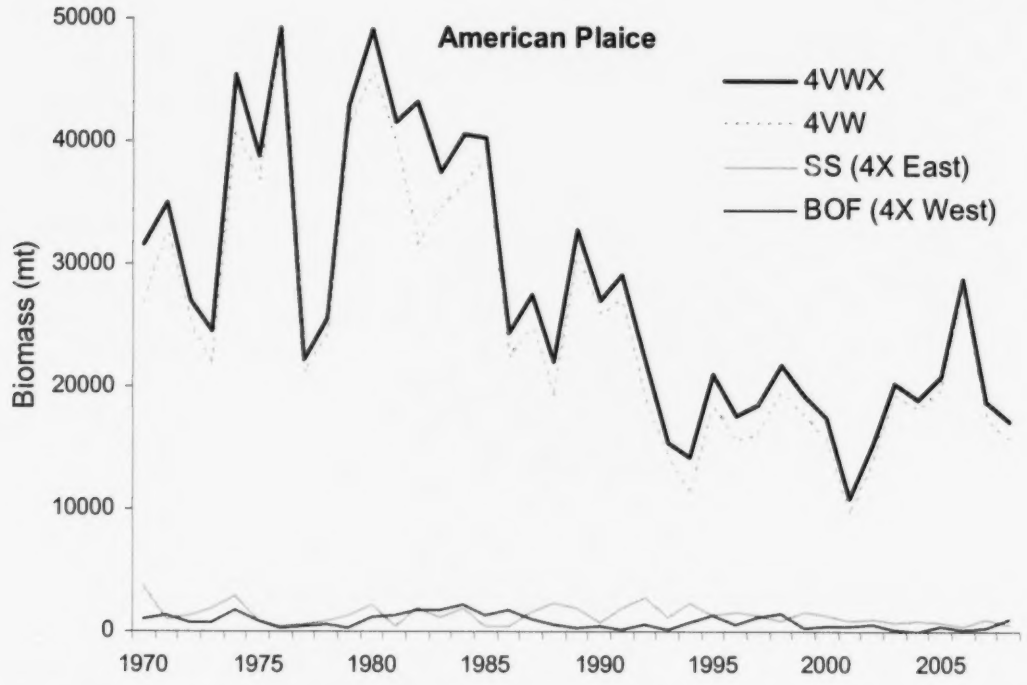

Figure 12b. Biomass estimate for American plaice from the Scotia-Fundy summer research vessel survey.

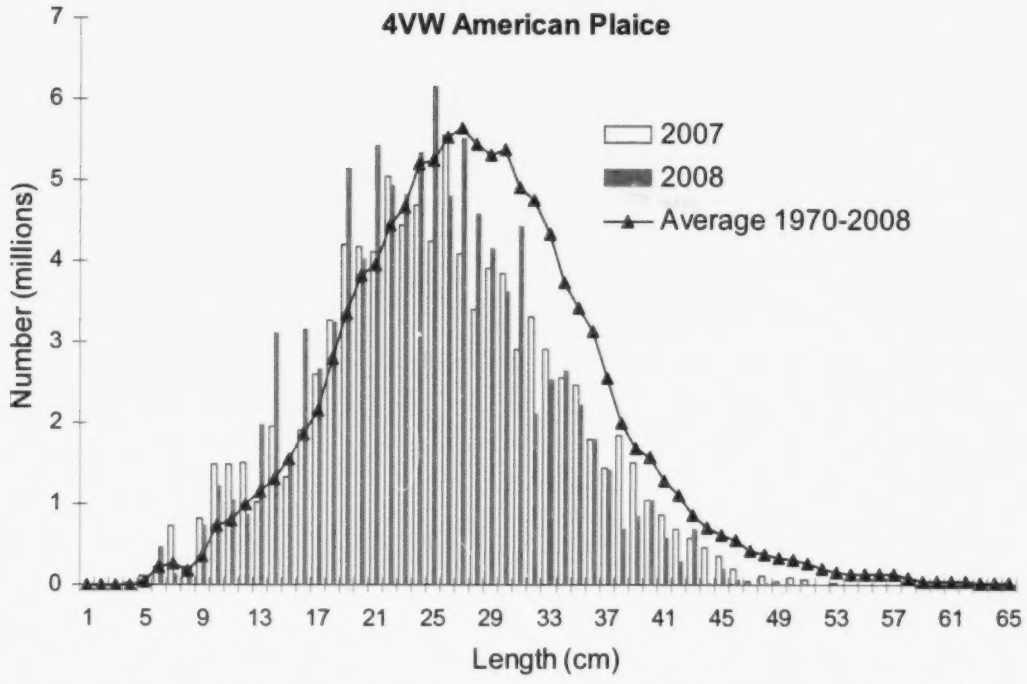

Figure 12c. Length composition for American plaice in NAFO divs. 4VW from the Scotia-Fundy summer research vessel survey.

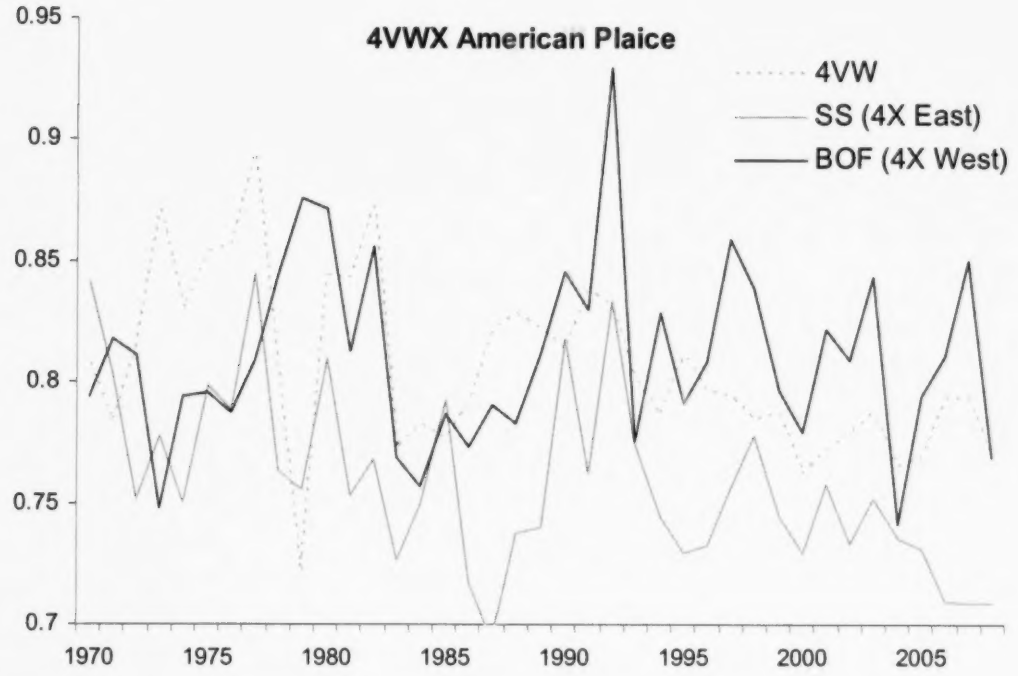

Figure 12d. Condition factor (Fulton's K) for American plaice from the Scotia-Fundy summer research vessel survey.

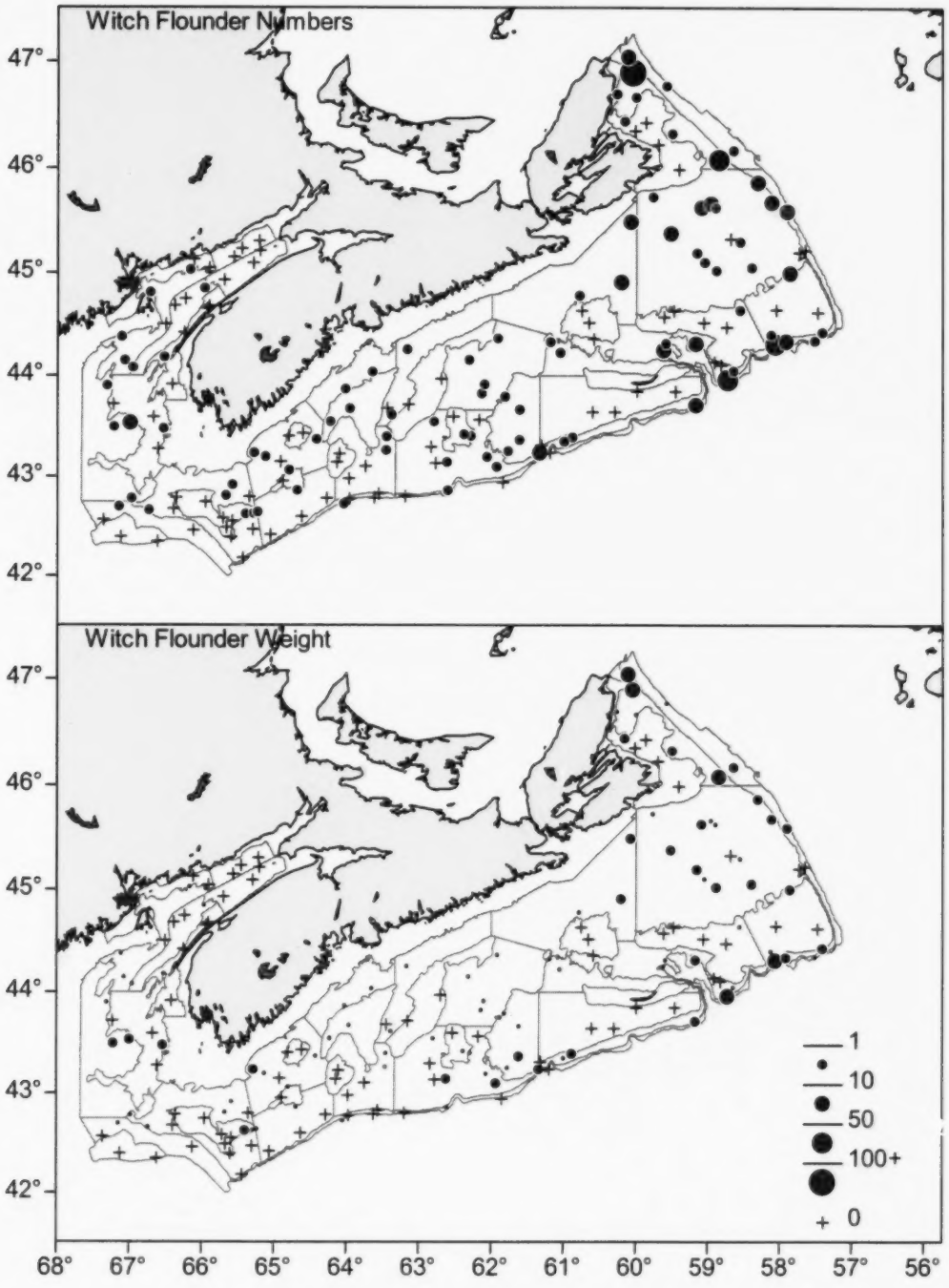

Figure 13a. Distribution of witch flounder catches during the 2008 Scotia-Fundy summer research vessel survey.

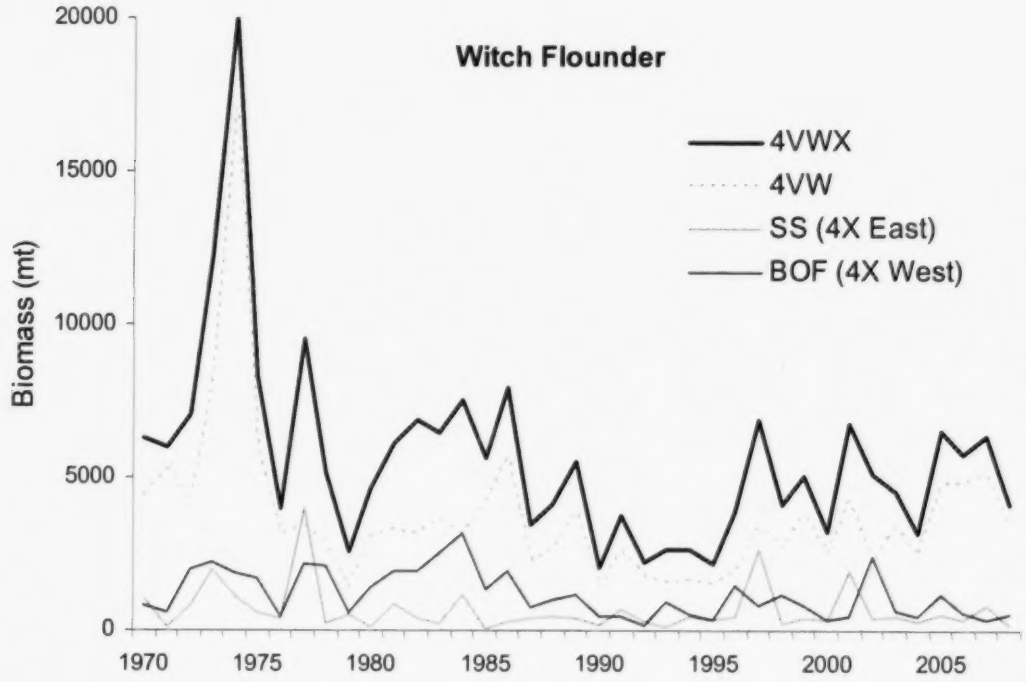

Figure 13b. Biomass estimate for witch flounder from the Scotia-Fundy summer research vessel survey.

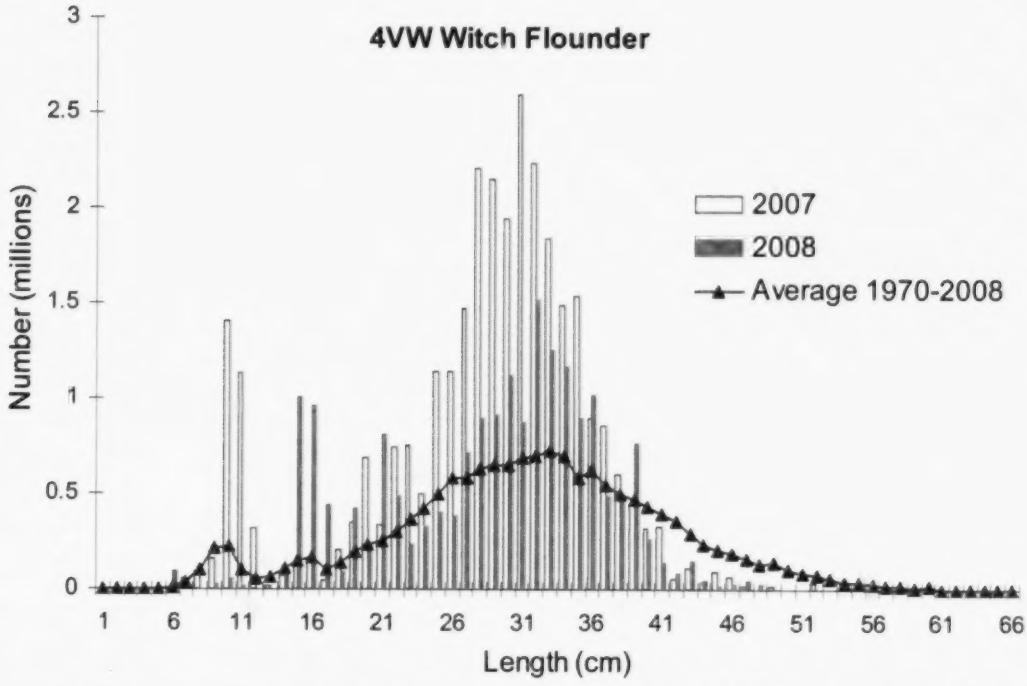

Figure 13c. Length composition for witch flounder in NAFO divs. 4VW from the Scotia-Fundy summer research vessel survey.

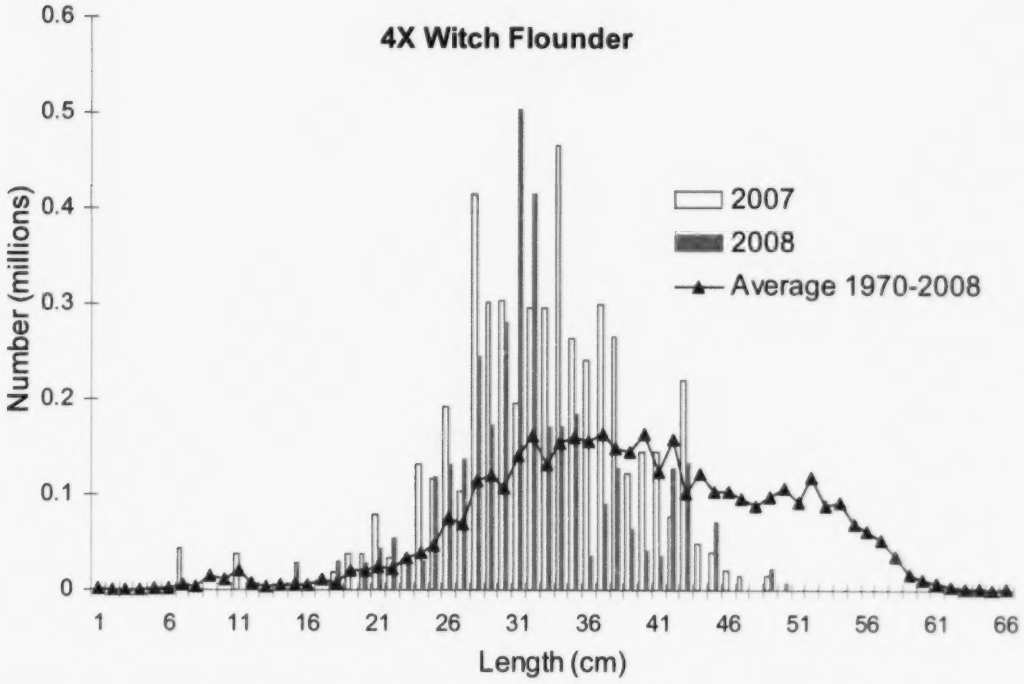

Figure 13d. Length composition for witch flounder in NAFO Div. 4X from the Scotia-Fundy summer research vessel survey.

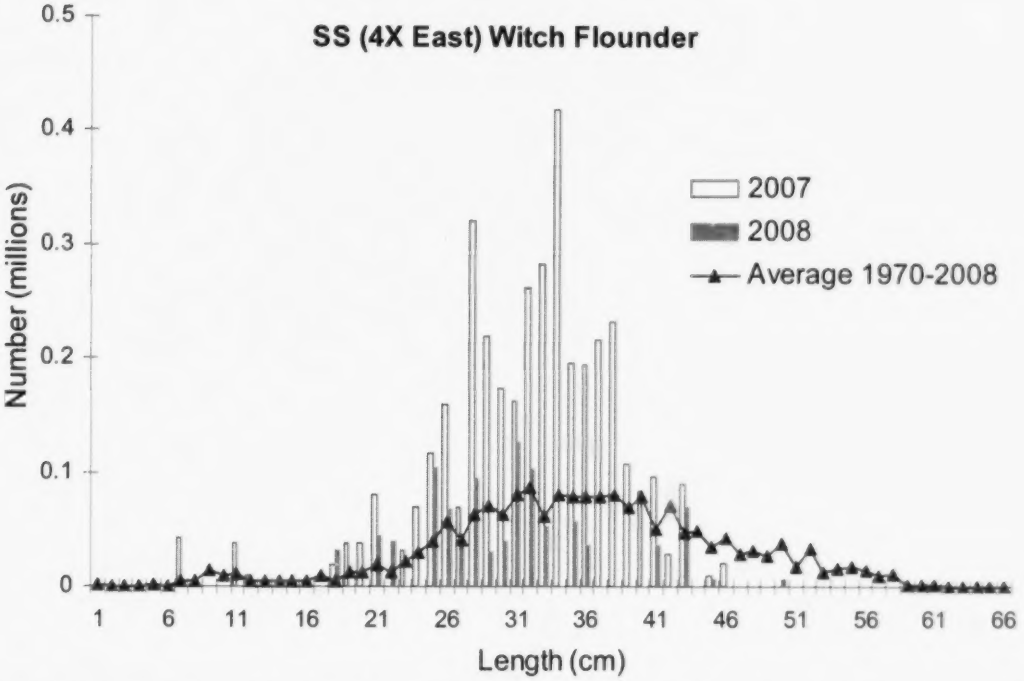

Figure 13e. Length composition for witch flounder in NAFO Div. 4X east from the Scotia-Fundy summer research vessel survey.

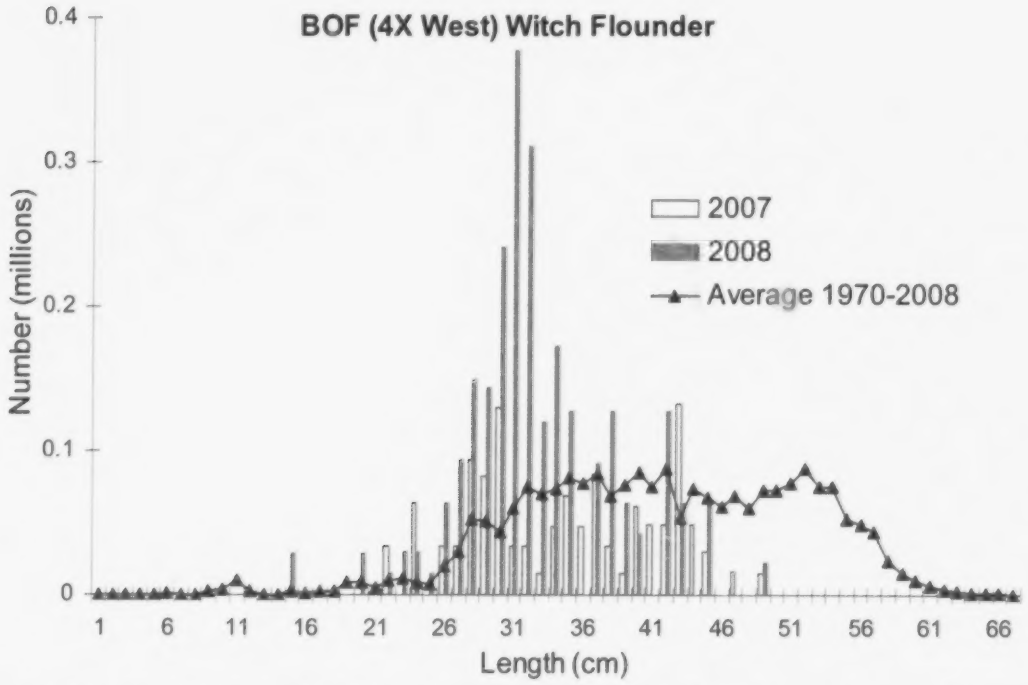

Figure 13f. Length composition for witch flounder in NAFO Div. 4X west from the Scotia-Fundy summer research vessel survey.

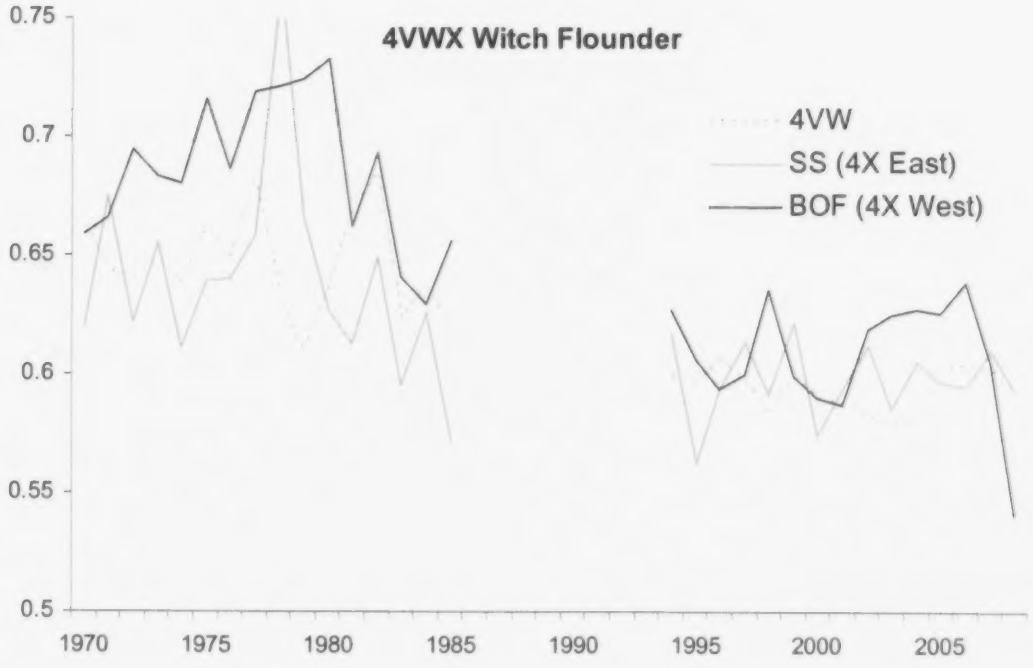

Figure 13g. Condition factor (Fulton's K) for witch flounder from the Scotia-Fundy summer research vessel survey.

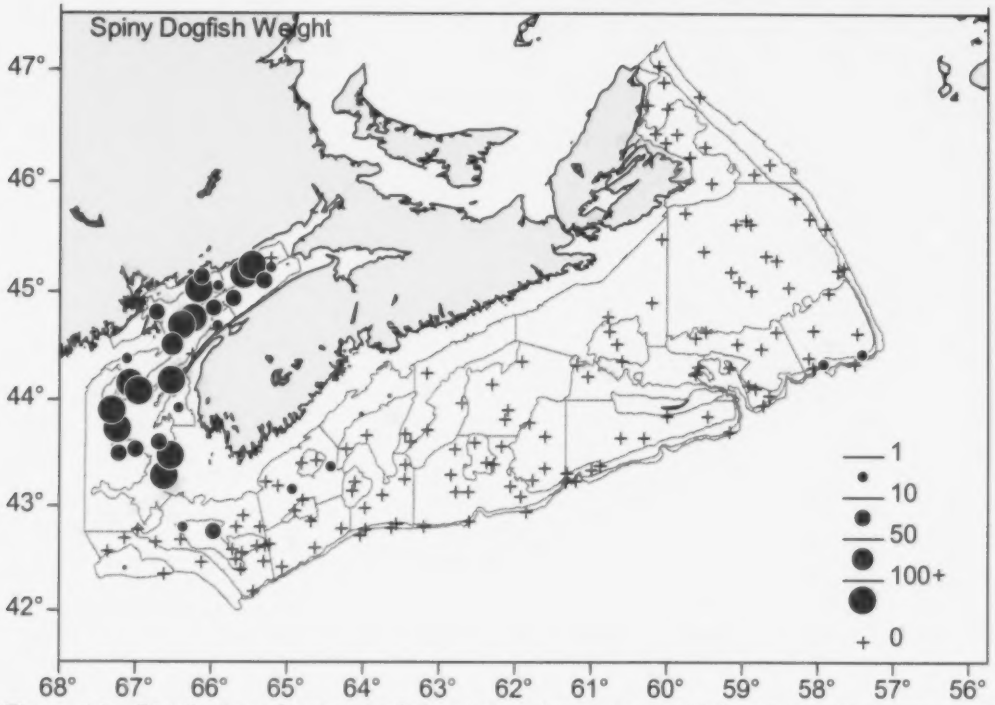

Figure 14a. Distribution of spiny dogfish catches during the 2008 Scotia-Fundy summer research vessel survey.

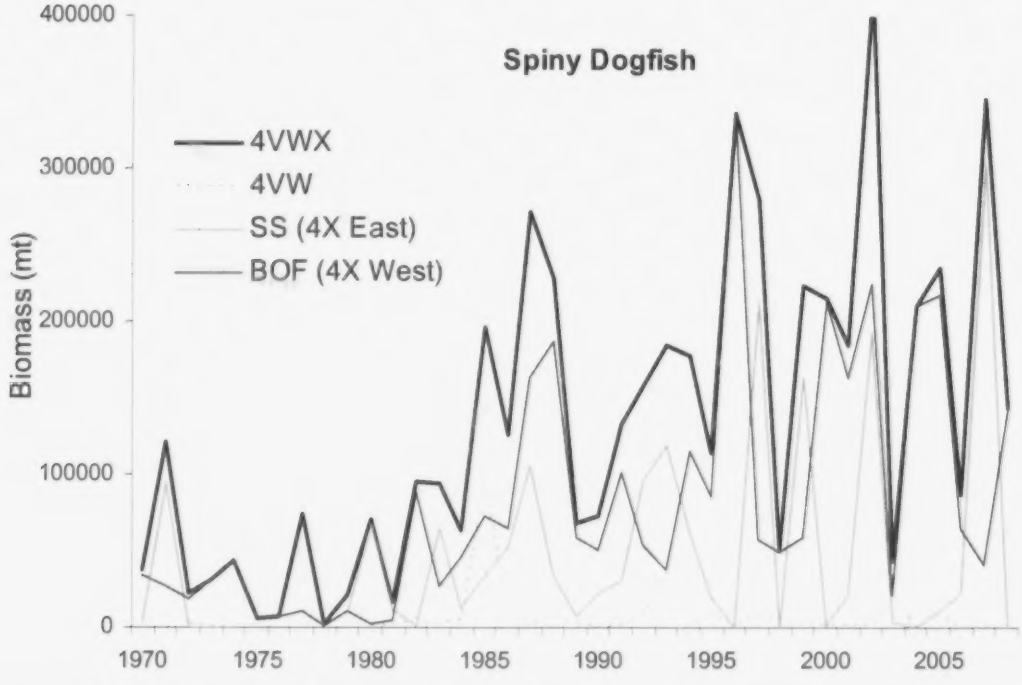

Figure 14b. Biomass estimate for spiny dogfish from the Scotia-Fundy summer research vessel survey.

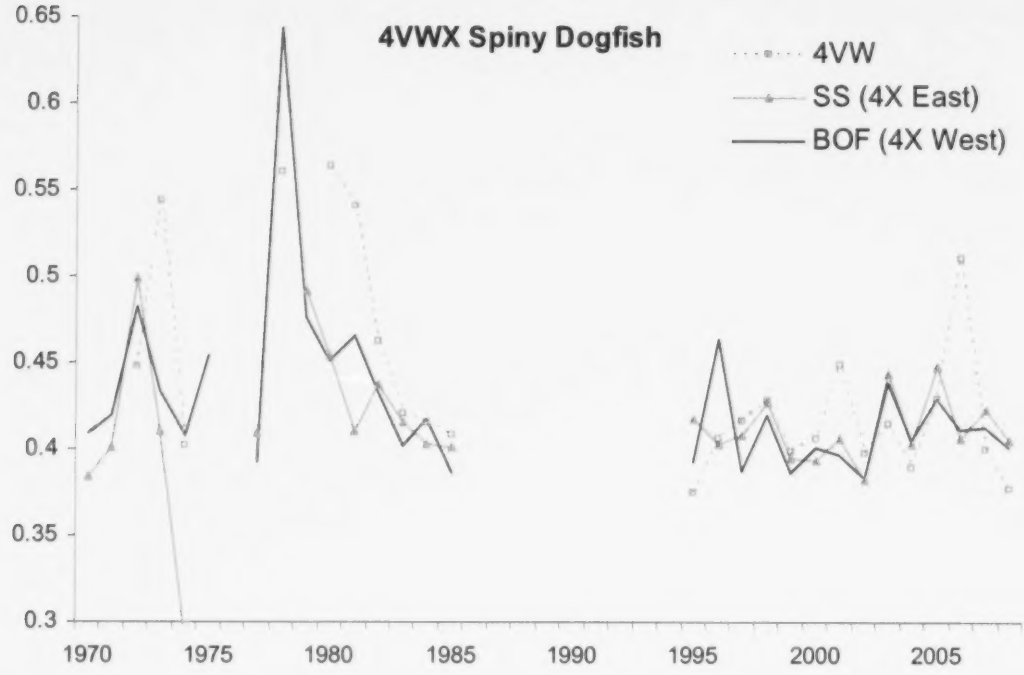

Figure 14c. Condition factor (Fulton's K) for spiny dogfish from the Scotia-Fundy summer research vessel survey.

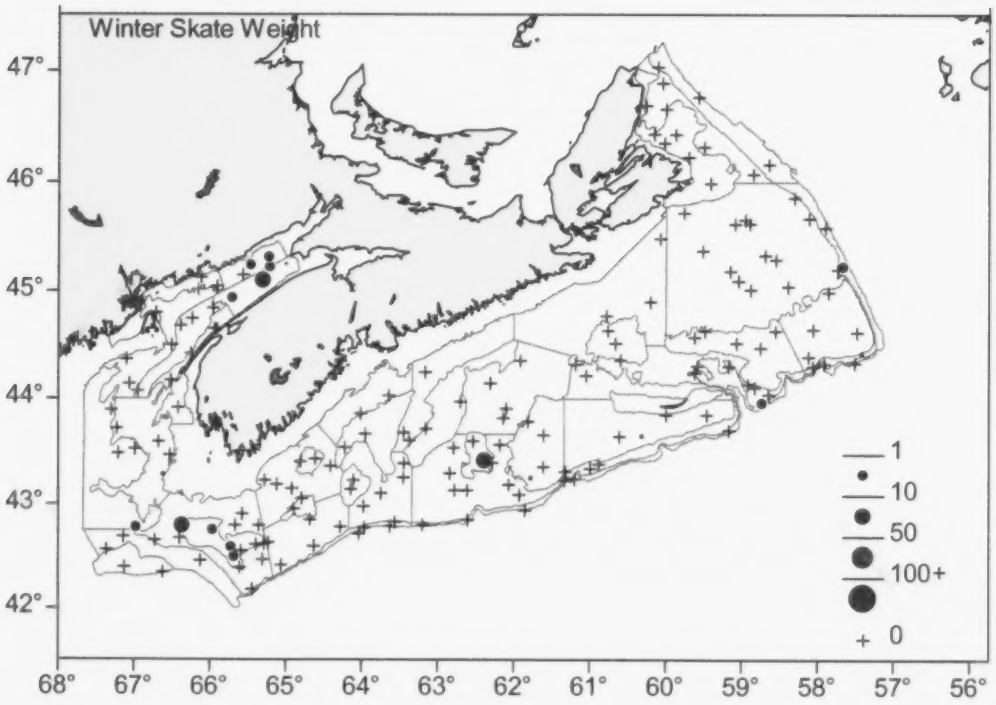

Figure 15a. Distribution of winter skate catches during the 2008 Scotia-Fundy summer research vessel survey.

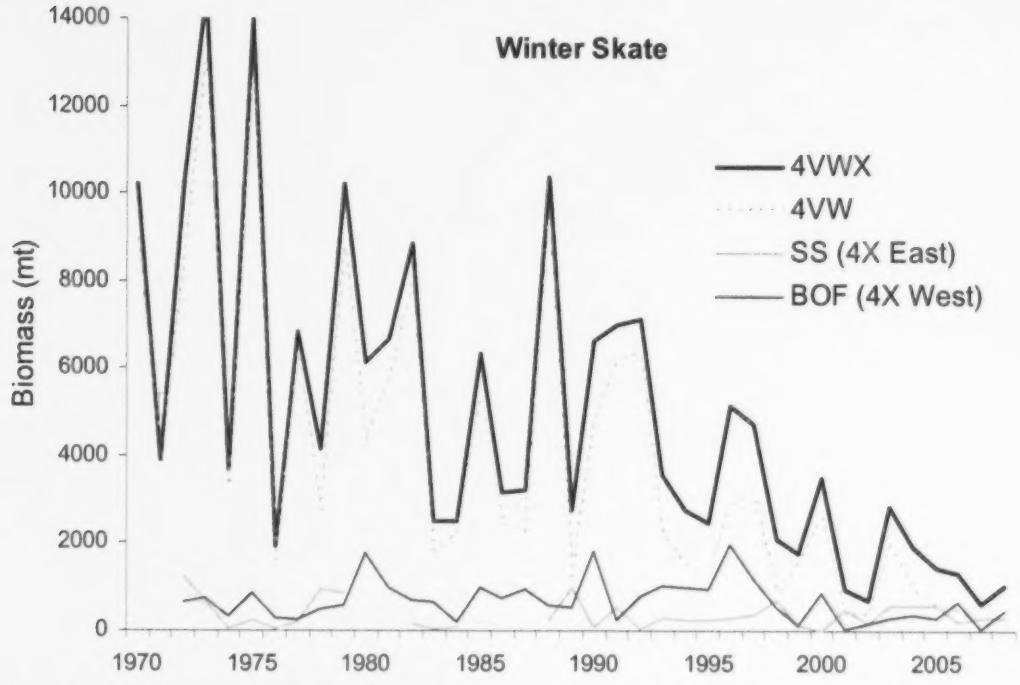

Figure 15b. Biomass estimate for winter skate from the Scotia-Fundy summer research vessel survey.

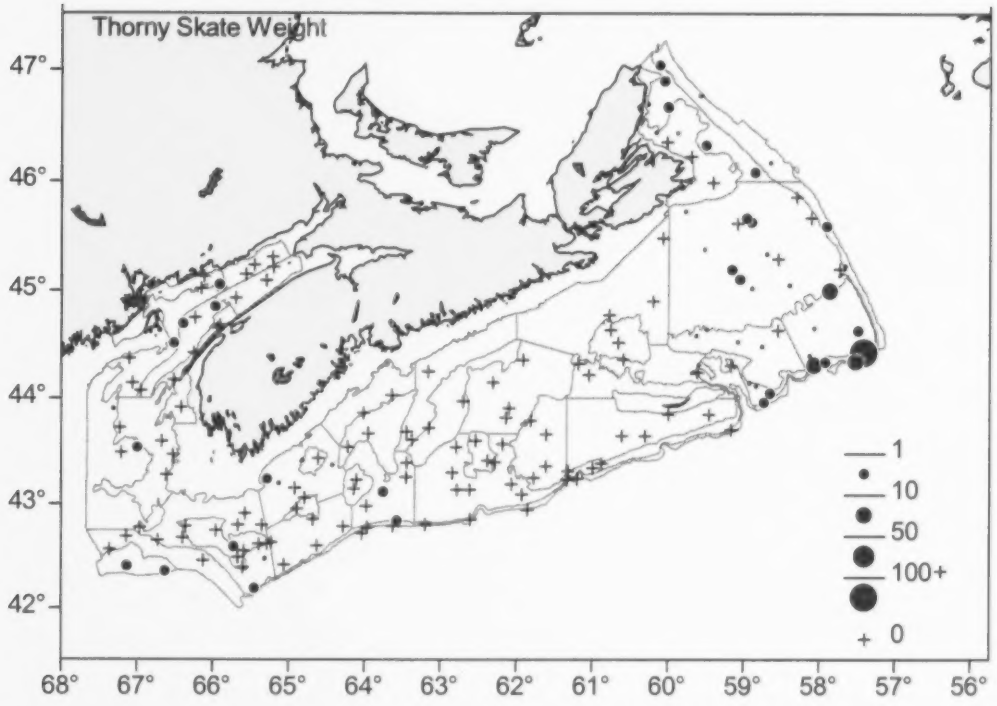

Figure 16a. Distribution of thorny skate catches during the Scotia-Fundy summer research vessel survey.

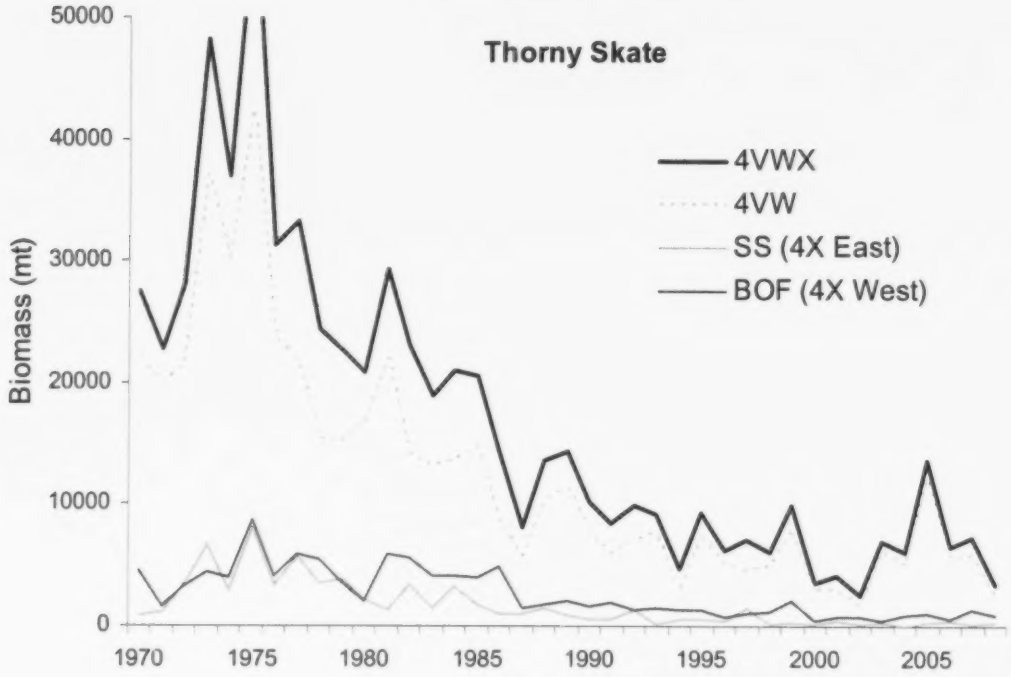

Figure 16b. Biomass estimate for thorny skate from the Scotia-Fundy summer research vessel survey.

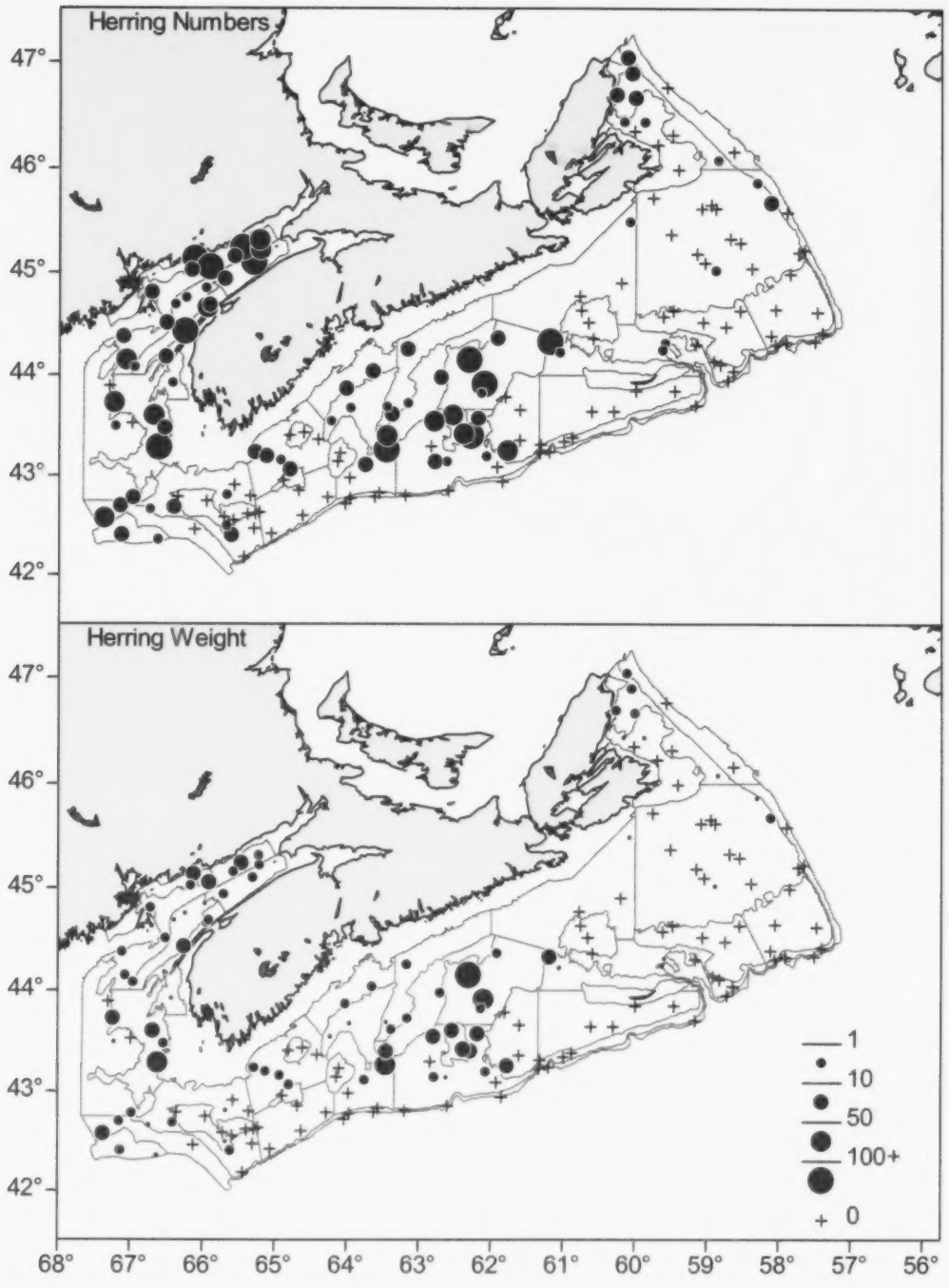

Figure 17a. Distribution of Atlantic herring catches during the 2008 Scotia-Fundy summer research vessel survey.

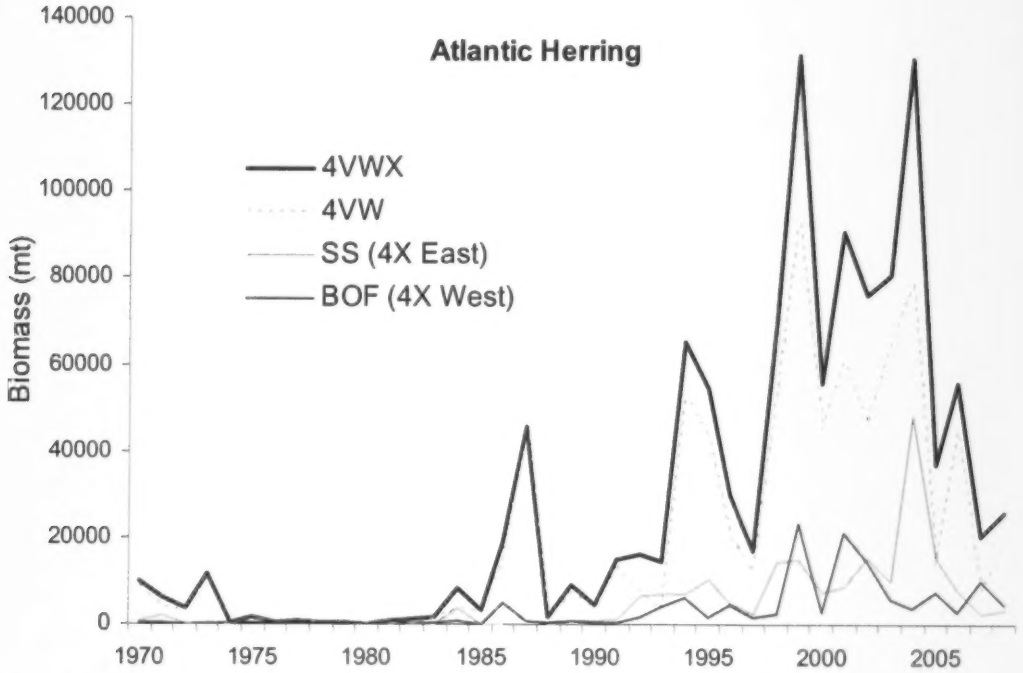

Figure 17b. Biomass estimate for Atlantic herring from the Scotia-Fundy summer research vessel survey.

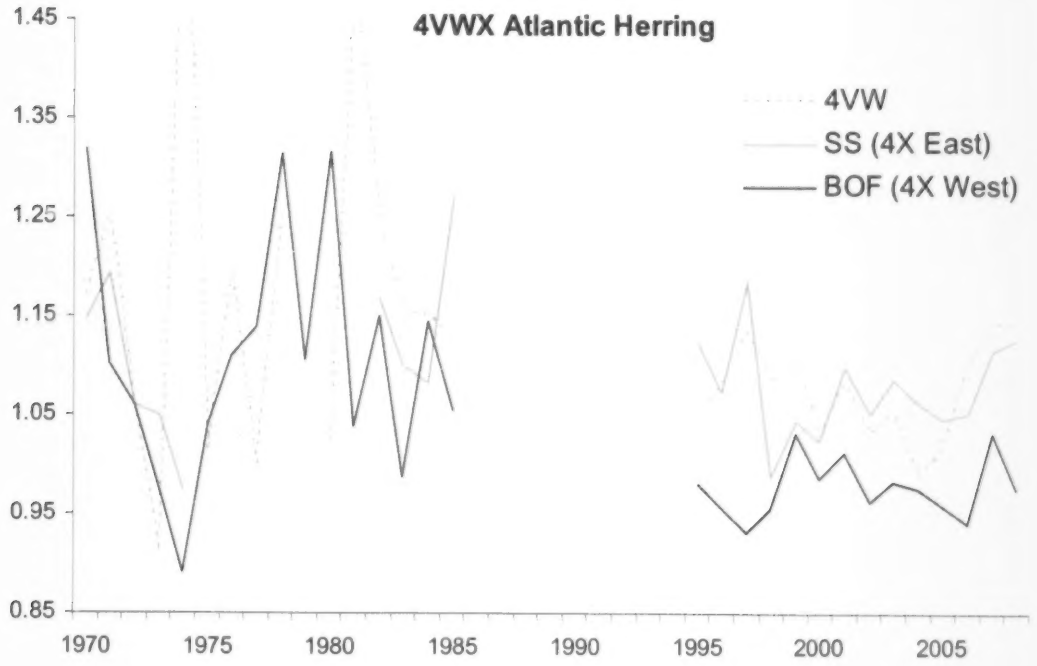

Figure 17c. Condition factor (Fulton's K) for Atlantic herring from the Scotia-Fundy summer research vessel survey.

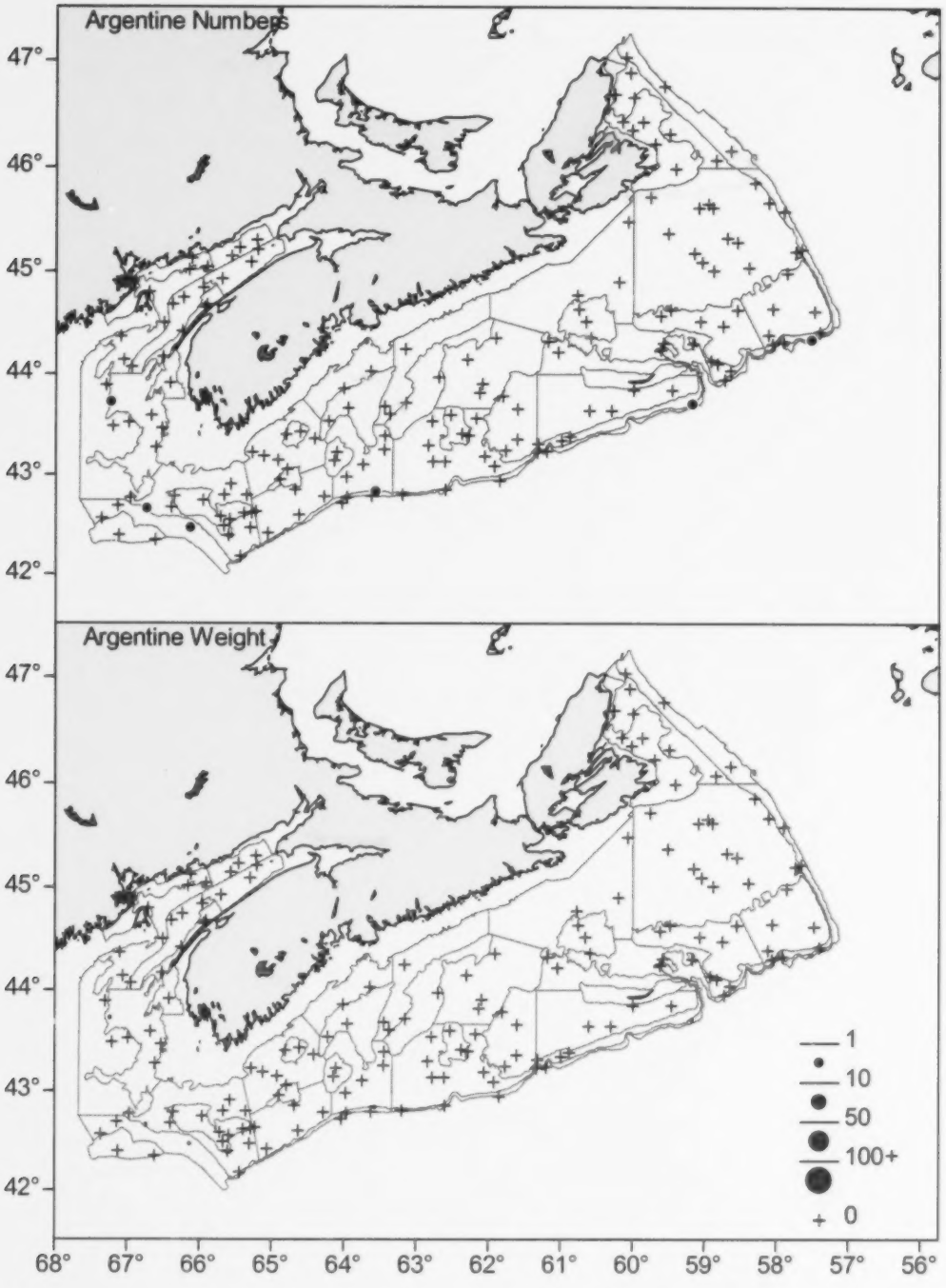

Figure 18a. Distribution of argentine catches during the 2008 Scotia-Fundy summer research vessel survey.

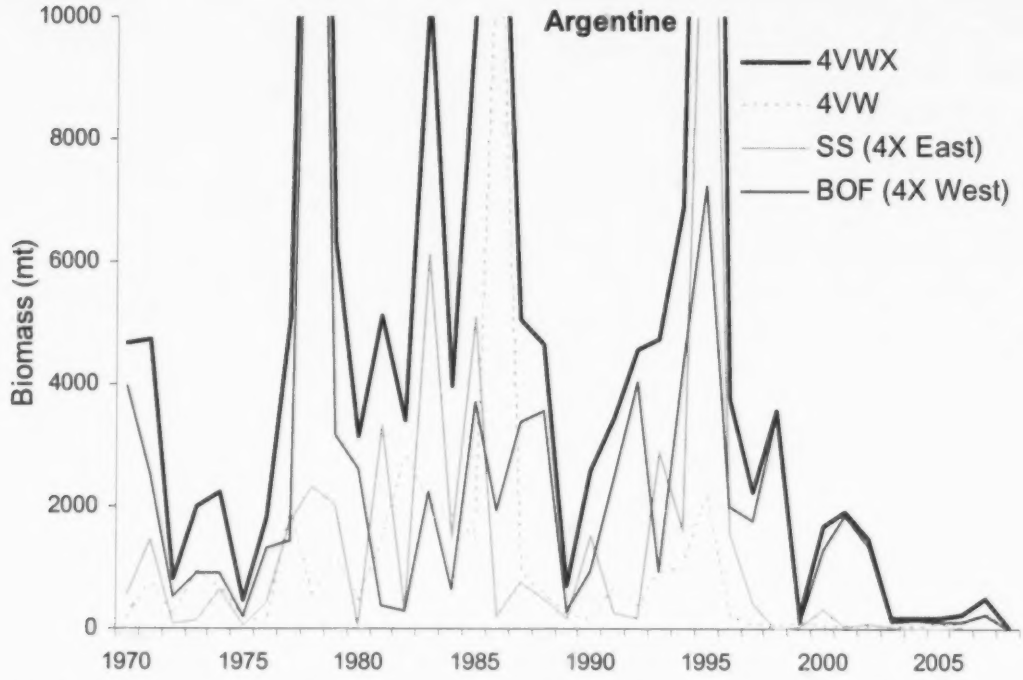

Figure 18b. Biomass estimate for argentine from the Scotia-Fundy summer research vessel survey.

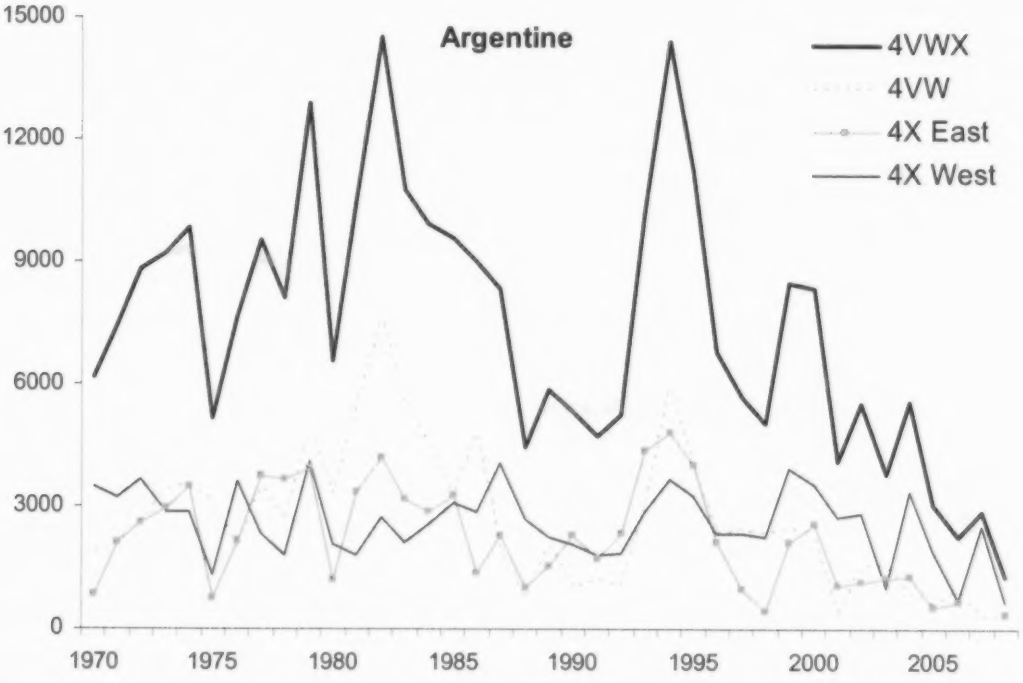

Figure 18c. Stratified area occupied by argentine from the Scotia-Fundy summer research vessel survey.

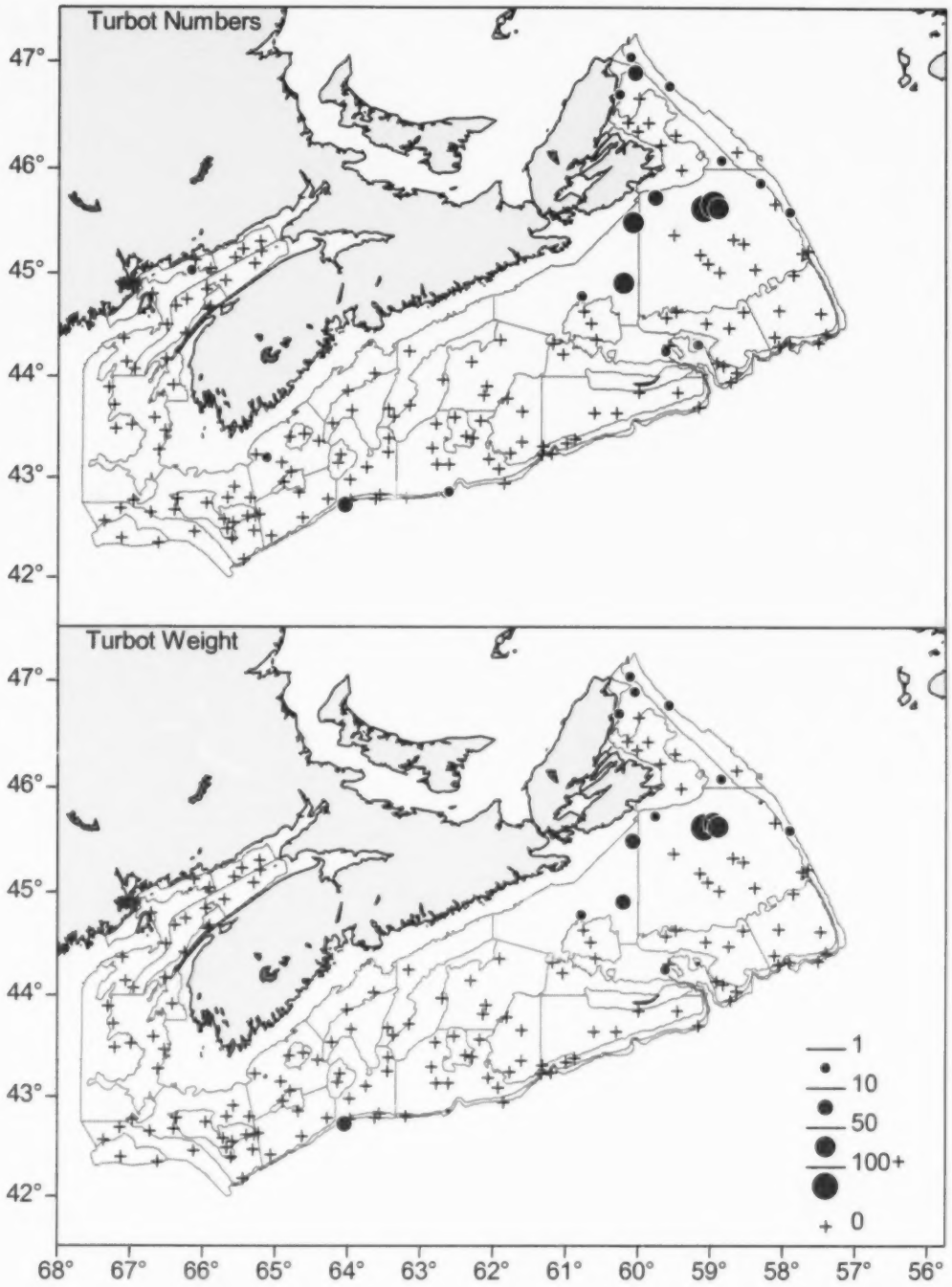

Figure 19a. Distribution of turbot catches during the 2008 Scotia-Fundy summer research vessel survey.

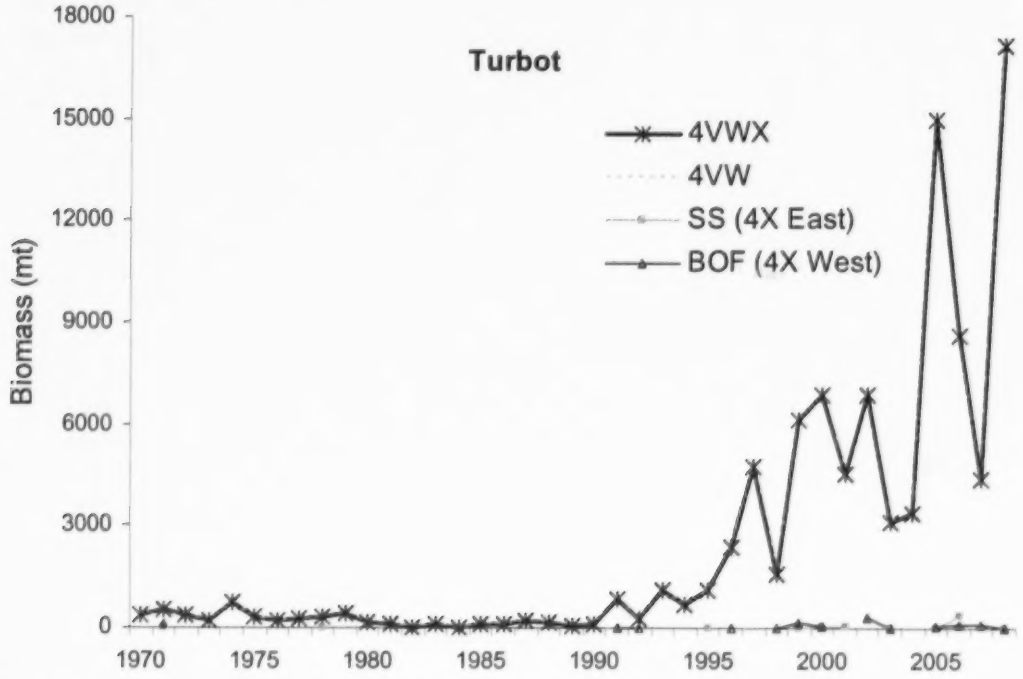

Figure 19b. Biomass estimate for turbot from the Scotia-Fundy summer research vessel survey.

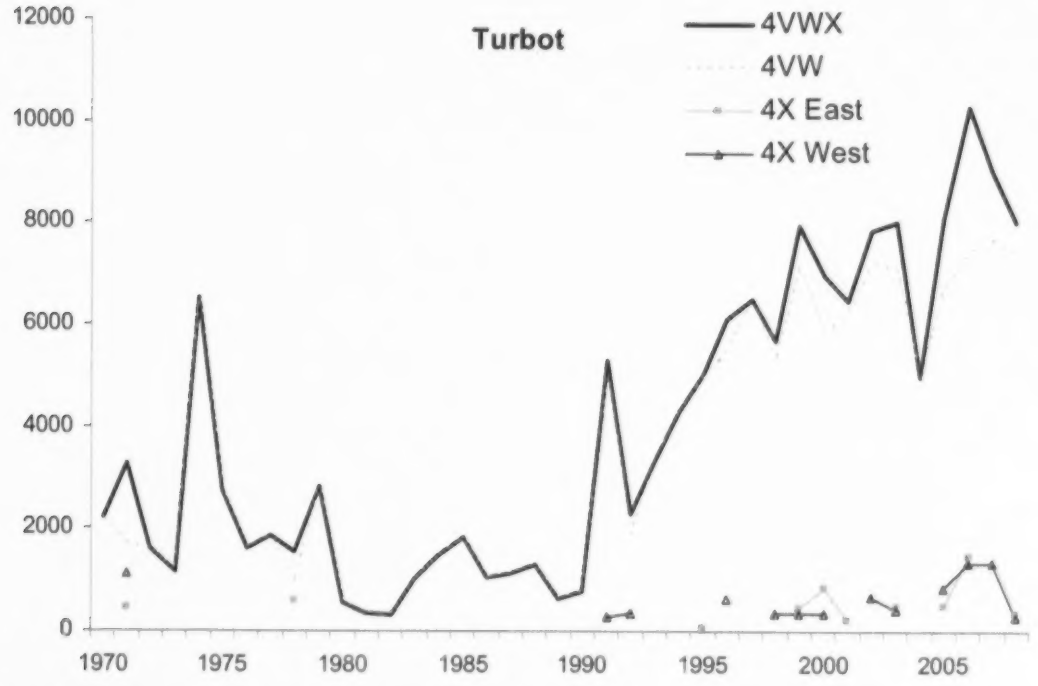

Figure 19c. Area occupied for turbot from the Scotia-Fundy summer research vessel survey.

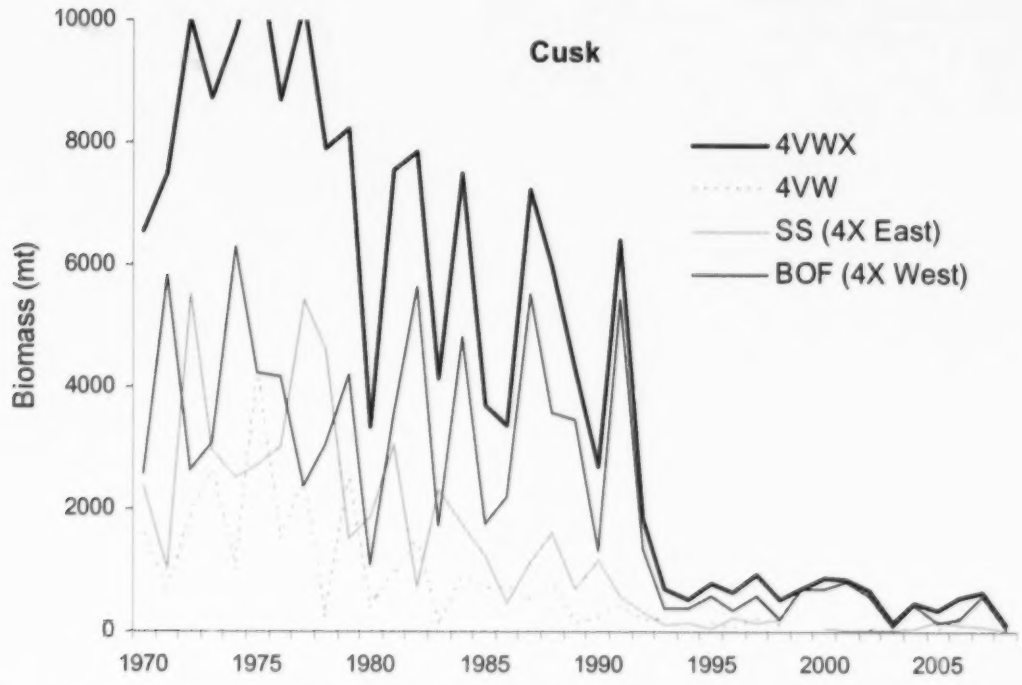

Figure 20. Biomass estimate for cusk from the Scotia-Fundy summer research vessel survey.

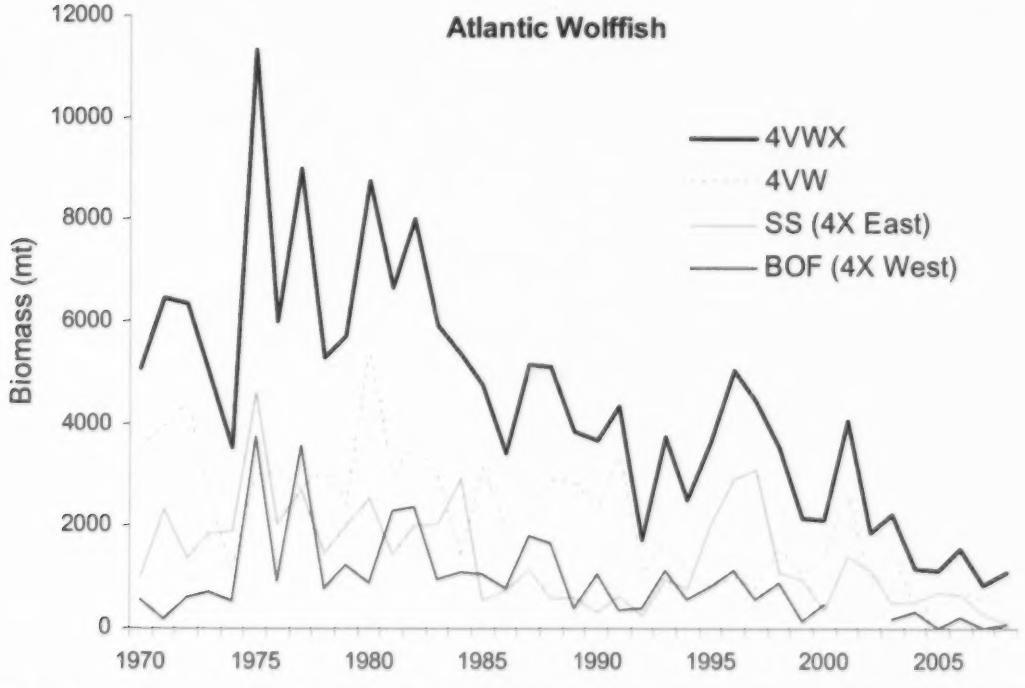

Figure 21. Biomass estimate for Atlantic wolffish from the Scotia-Fundy summer research vessel survey.

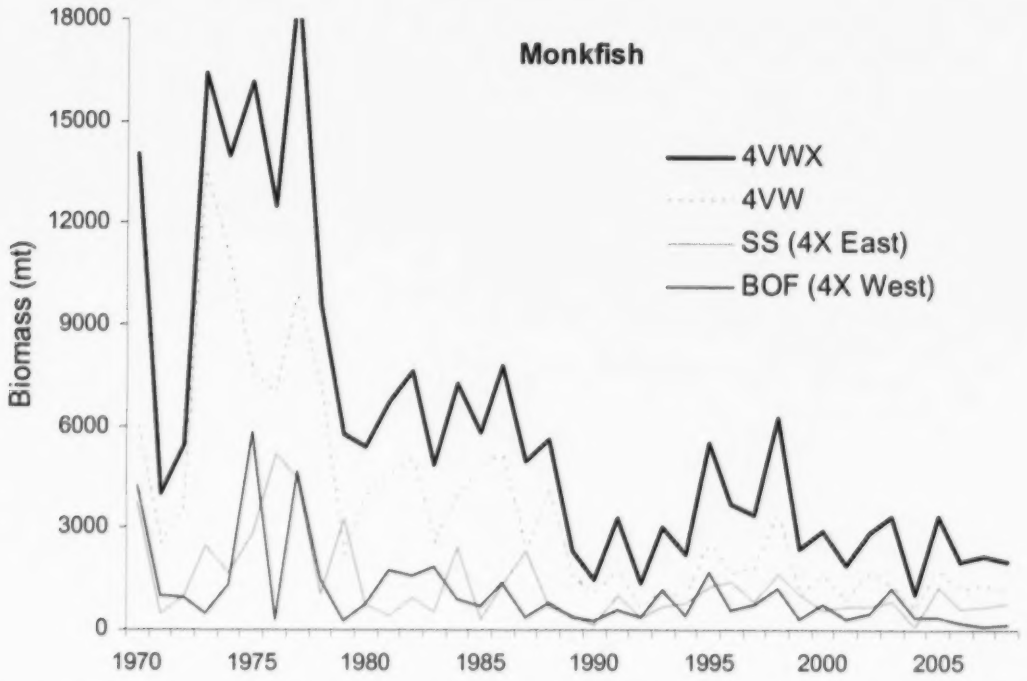

Figure 22. Biomass estimate for monkfish from the Scotia-Fundy summer research vessel survey.

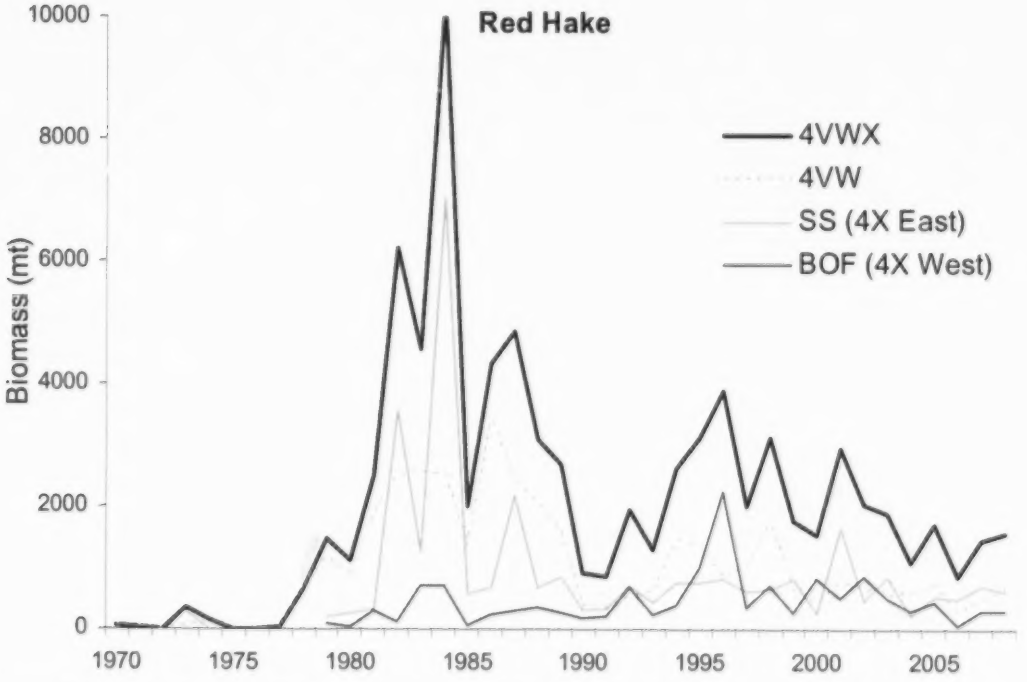

Figure 23. Biomass estimate for red hake from the Scotia-Fundy summer research vessel survey.

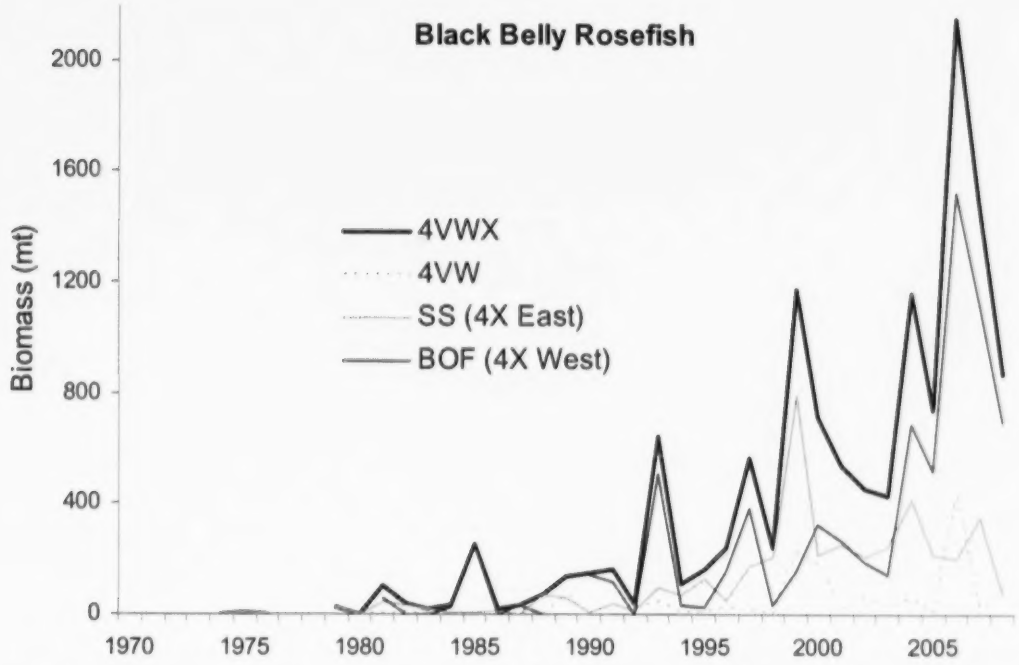

Figure 24. Biomass estimate for blackbelly rosefish from the Scotia-Fundy summer research vessel survey.

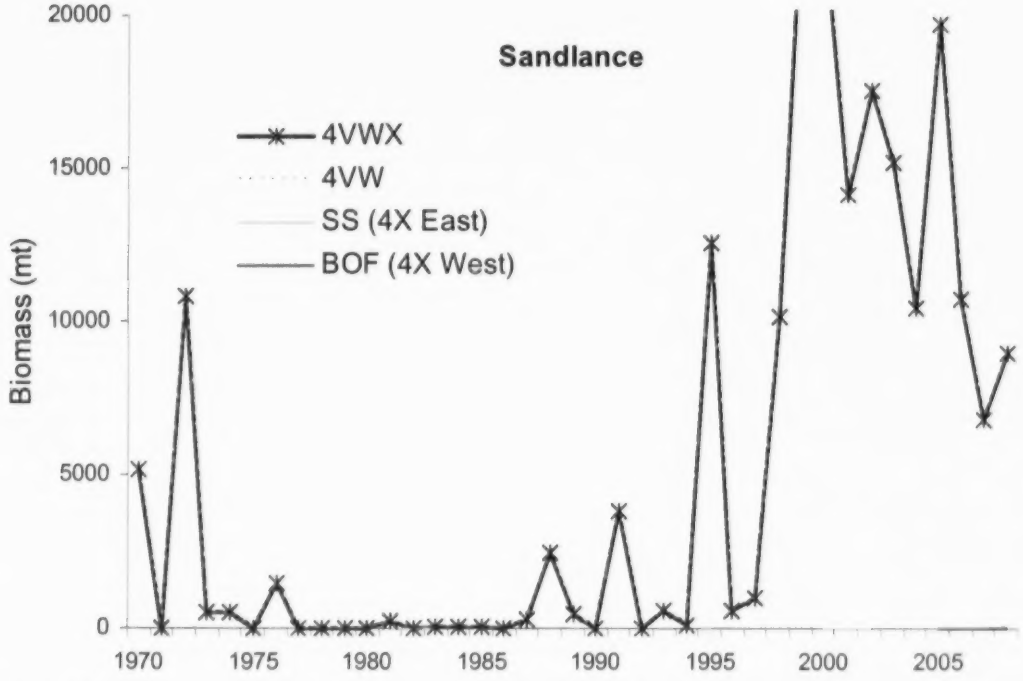

Figure 25. Biomass estimate for sand lance from the Scotia-Fundy summer research vessel survey.

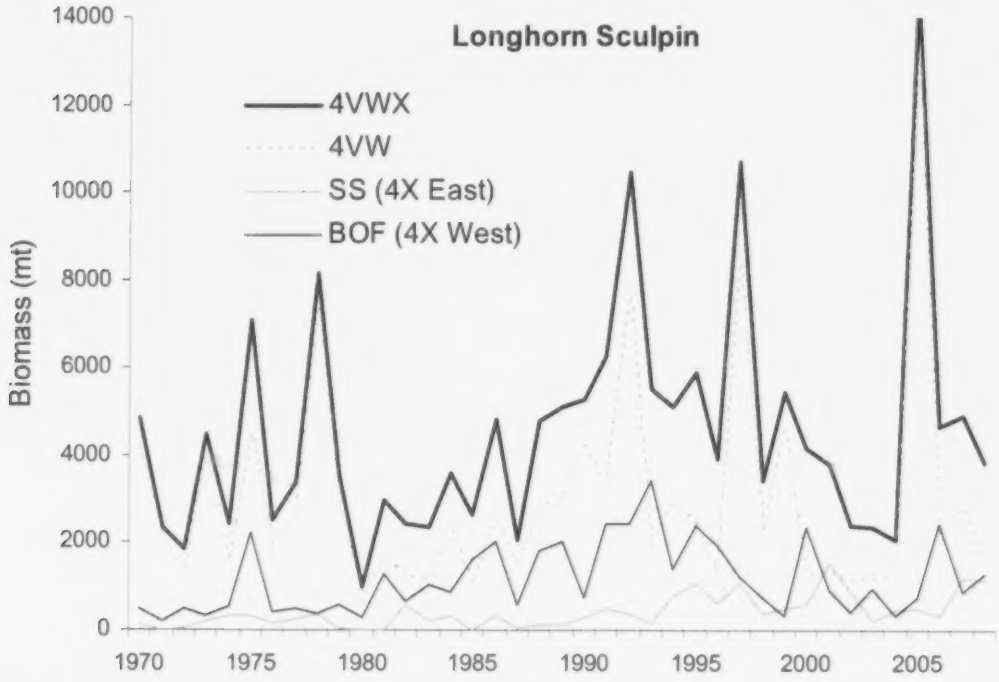

Figure 26. Biomass estimate for longhorn sculpin from the Scotia-Fundy summer research vessel survey.

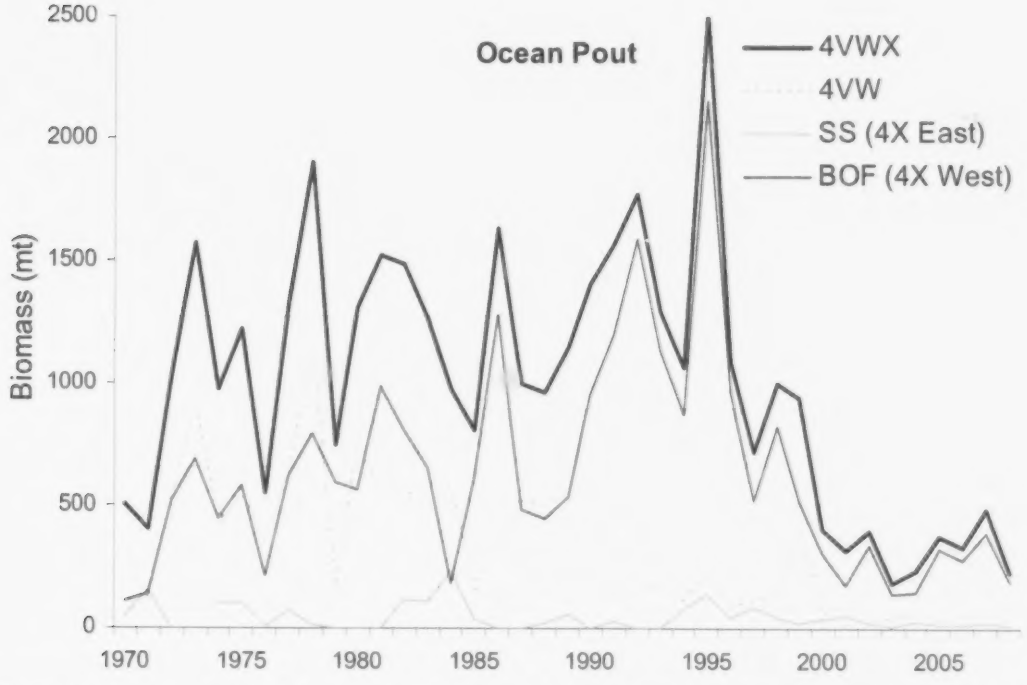

Figure 27. Biomass estimate for ocean pout from the Scotia-Fundy summer research vessel survey.

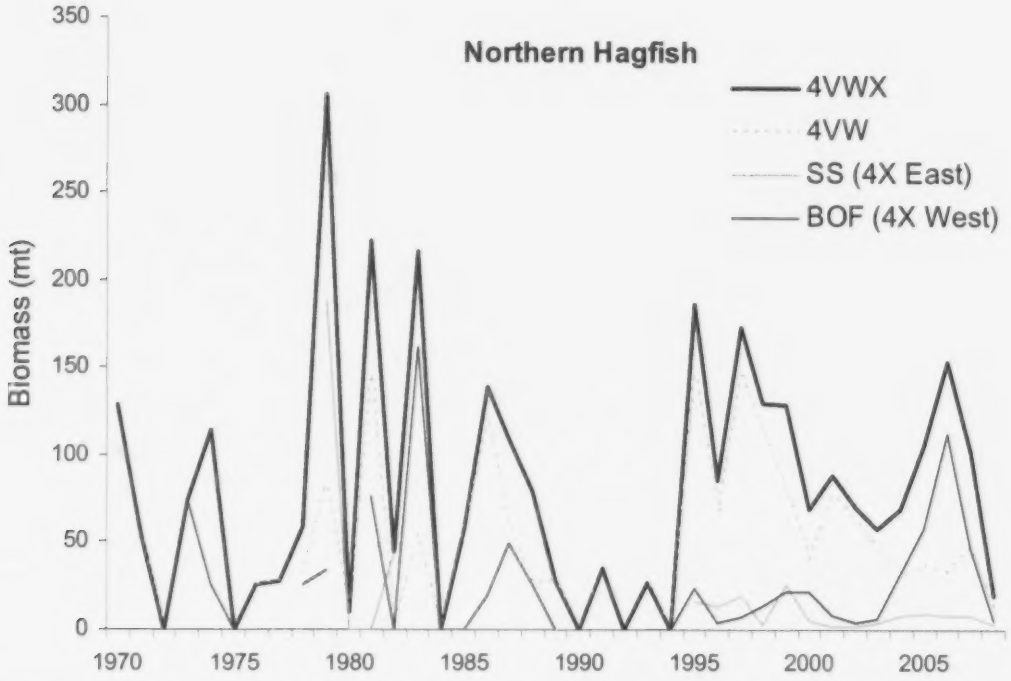

Figure 28. Biomass estimate for northern hagfish from the Scotia-Fundy summer research vessel survey.

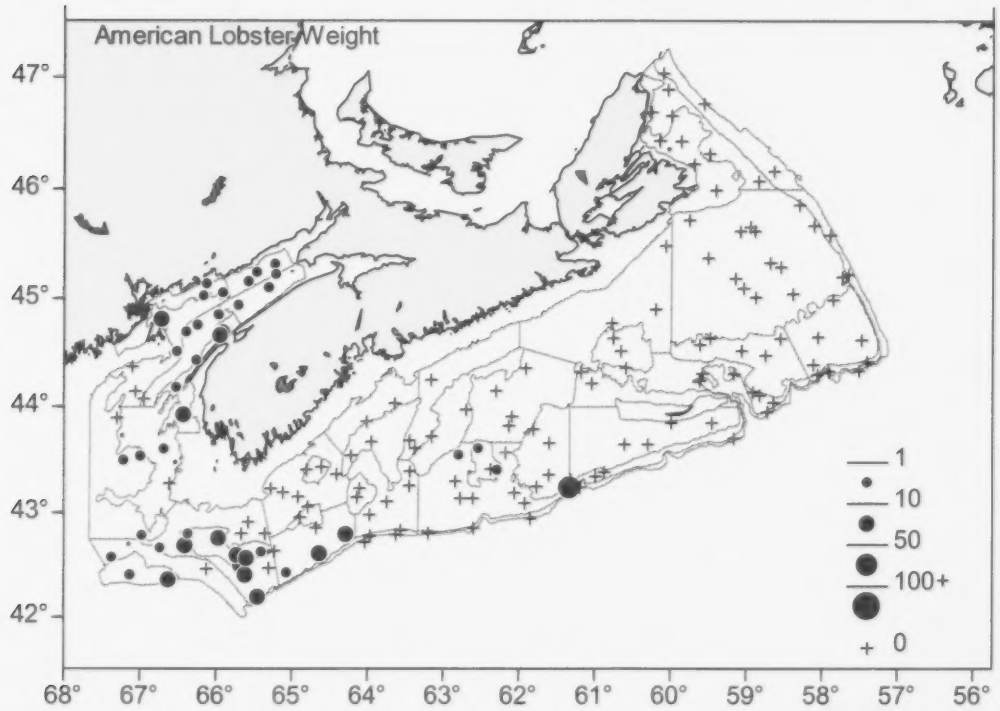

Figure 29a. Distribution of American lobster catches during the 2008 Scotia-Fundy summer research vessel survey.

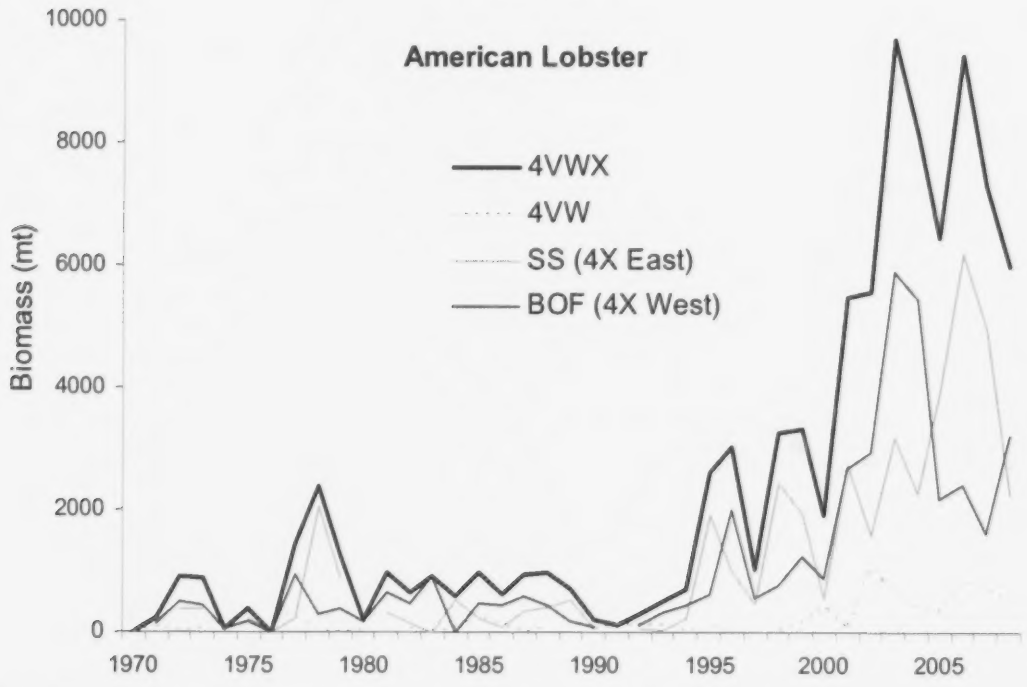

Figure 29b. Biomass estimate of American lobster from the Scotia-Fundy summer research vessel survey.

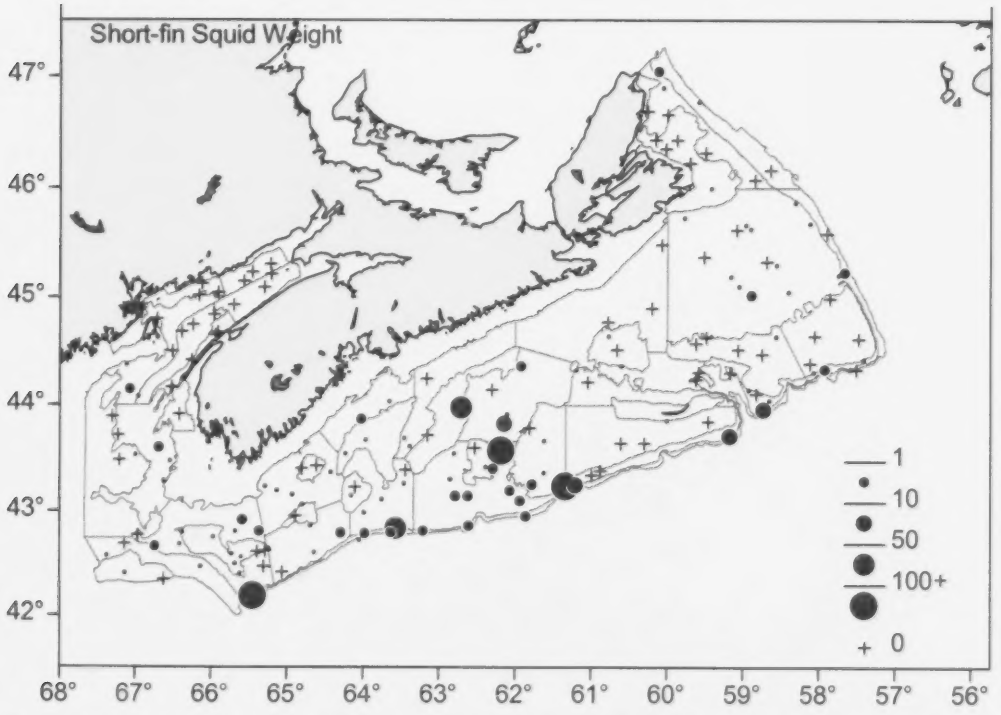

Figure 30a. Distribution of shortfin squid catches during the 2008 Scotia-Fundy summer research vessel survey.

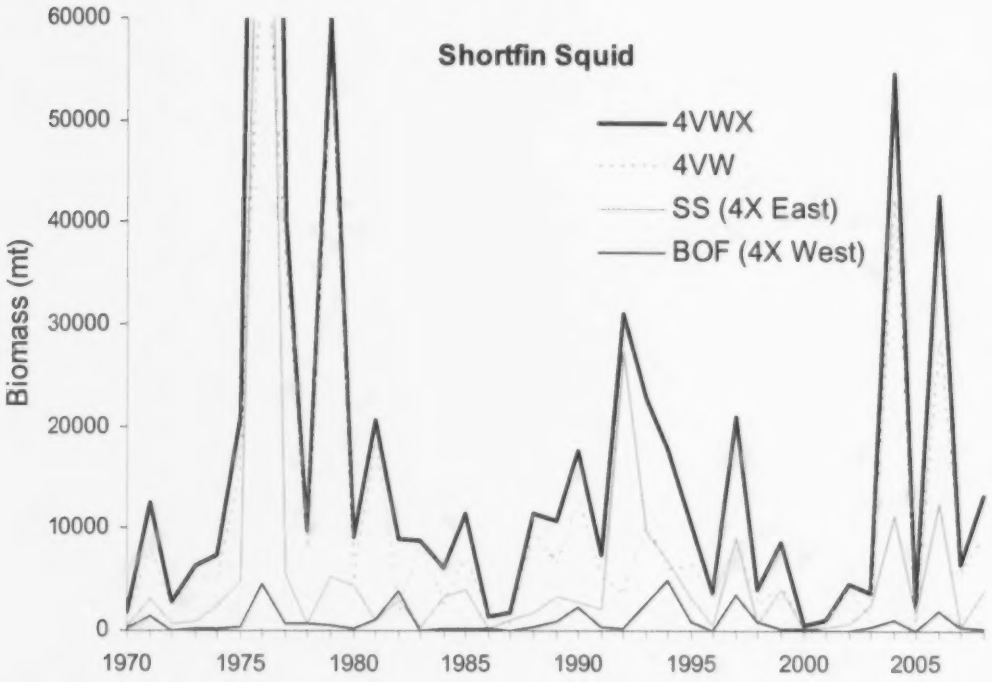

Figure 30b. Biomass estimate for shortfin squid from the Scotia-Fundy summer research vessel survey.

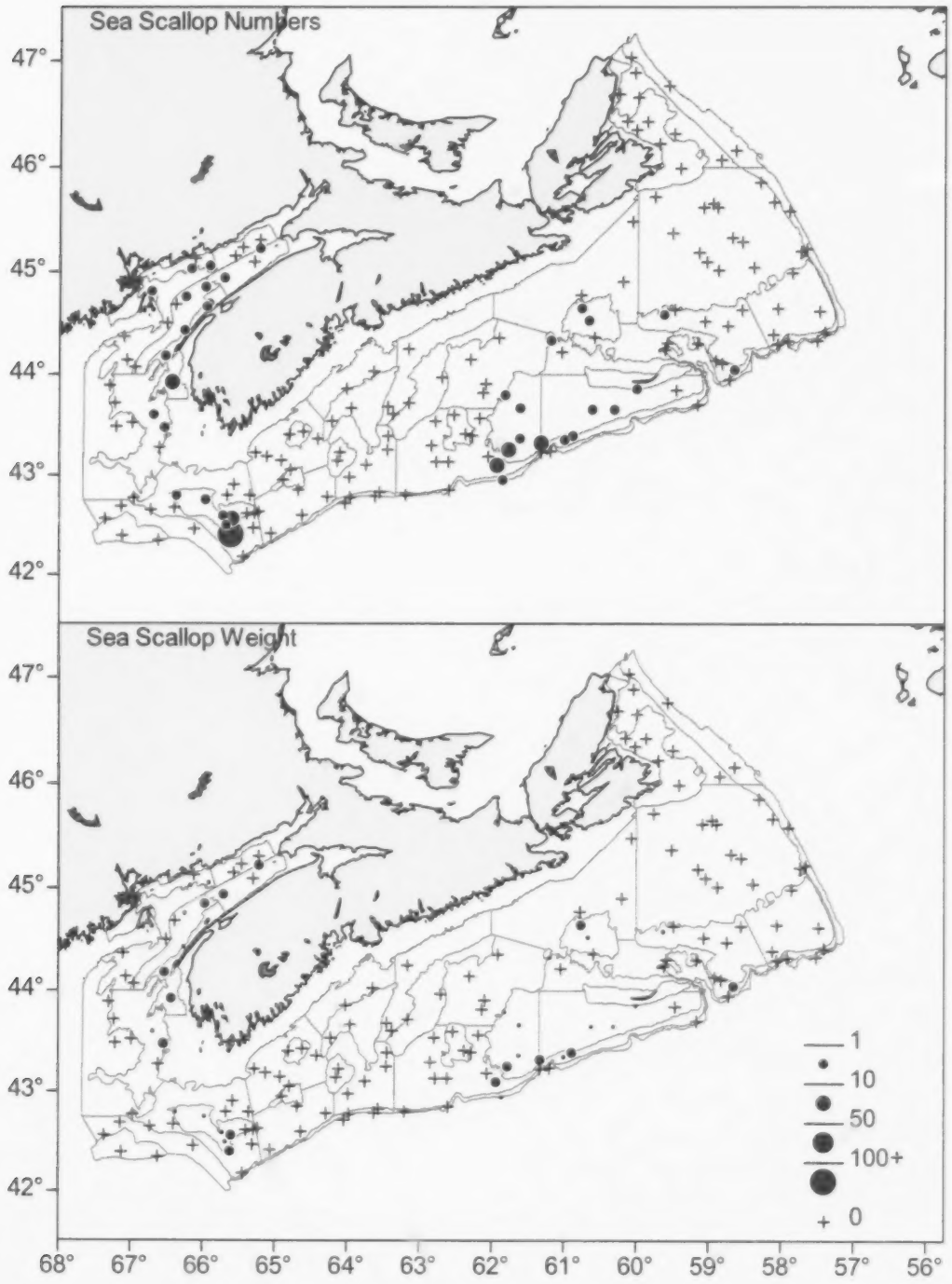

Figure 31a. Distribution of sea scallop catches during the 2008 Scotia-Fundy summer research vessel survey.

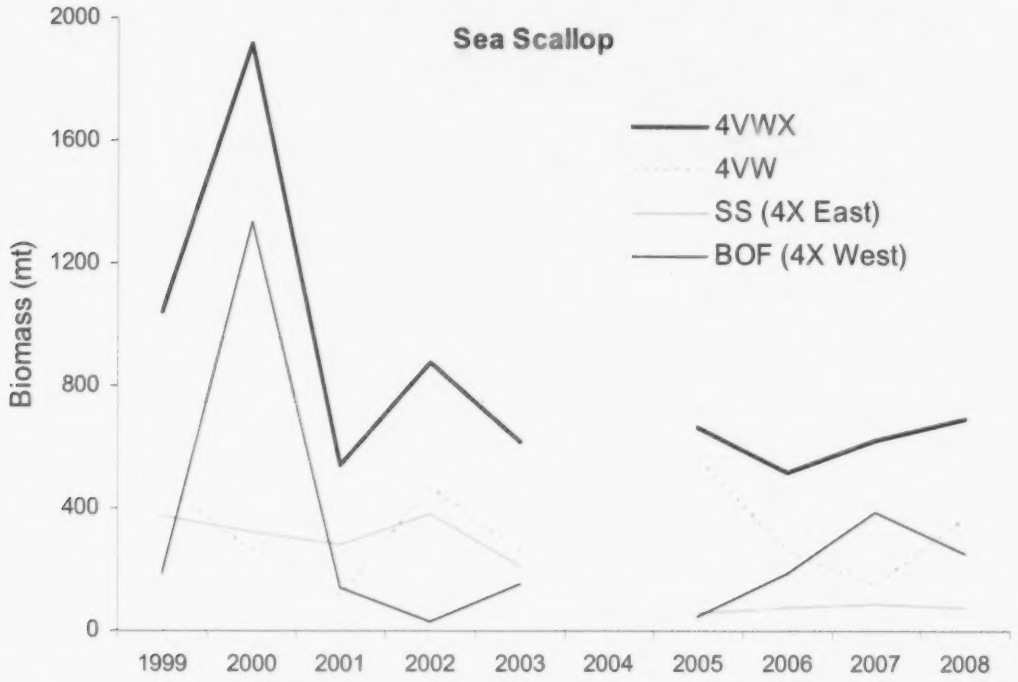

Figure 31b. Biomass estimate for sea scallop from the Scotia-Fundy summer research vessel survey.

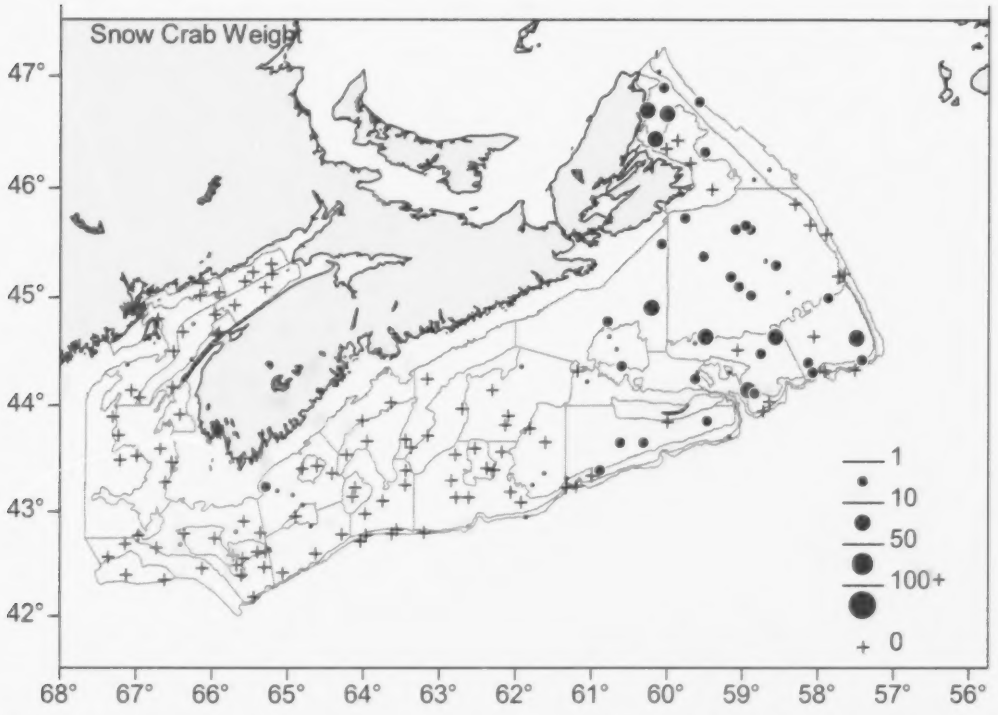

Figure 32a. Distribution of snow crab catches during the 2008 Scotia-Fundy summer research vessel survey.

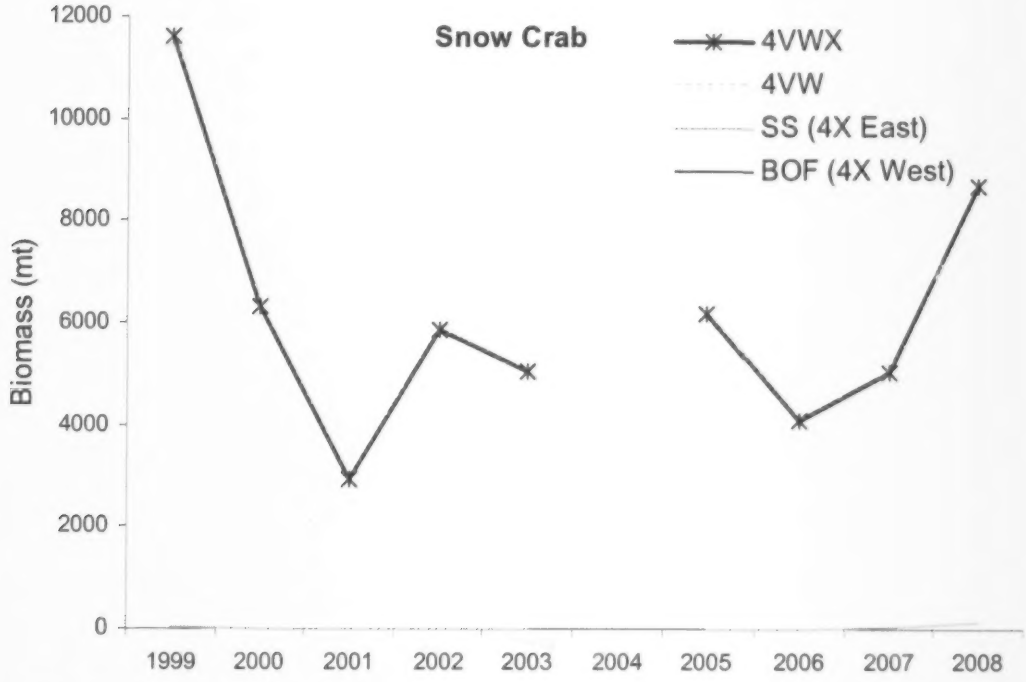

Figure 32b. Biomass estimate for snow crab from the Scotia-Fundy summer research vessel survey.

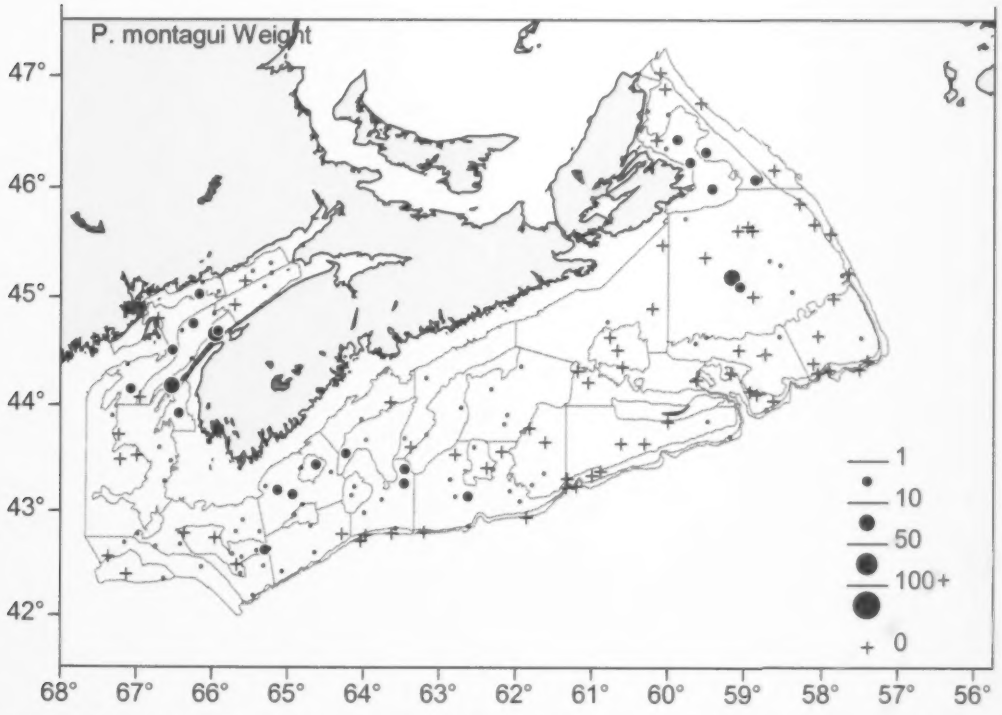

Figure 33. Distribution of Pandalus montagui catches during the 2008 Scotia-Fundy summer research vessel survey.

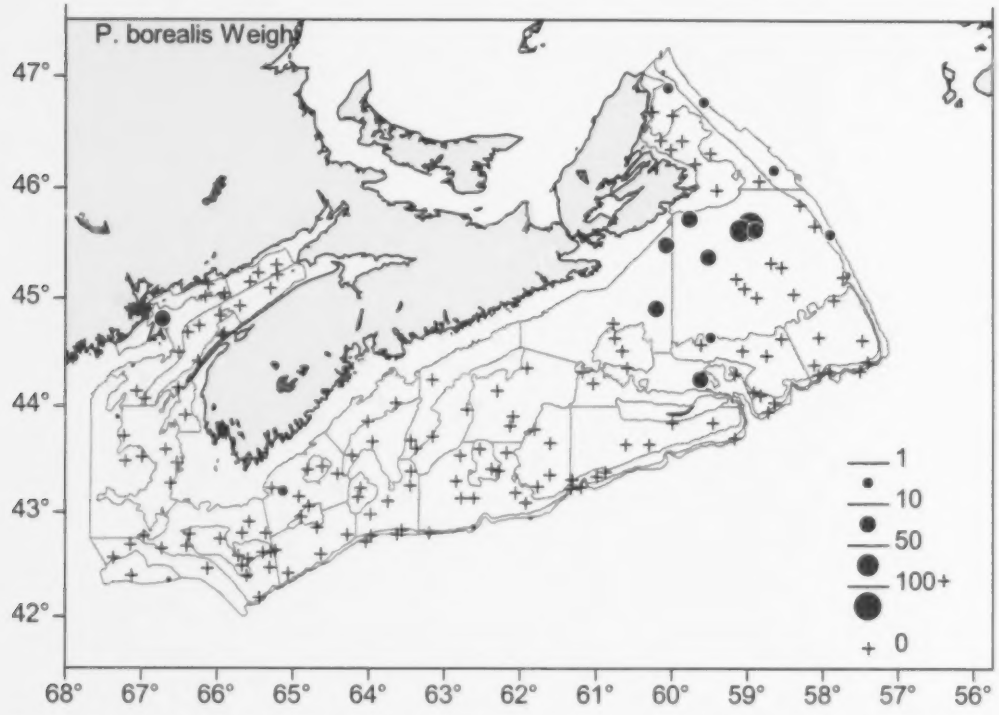

Figure 34. Distribution of Pandalus borealis catches during the 2008 Scotia-Fundy summer research vessel survey.

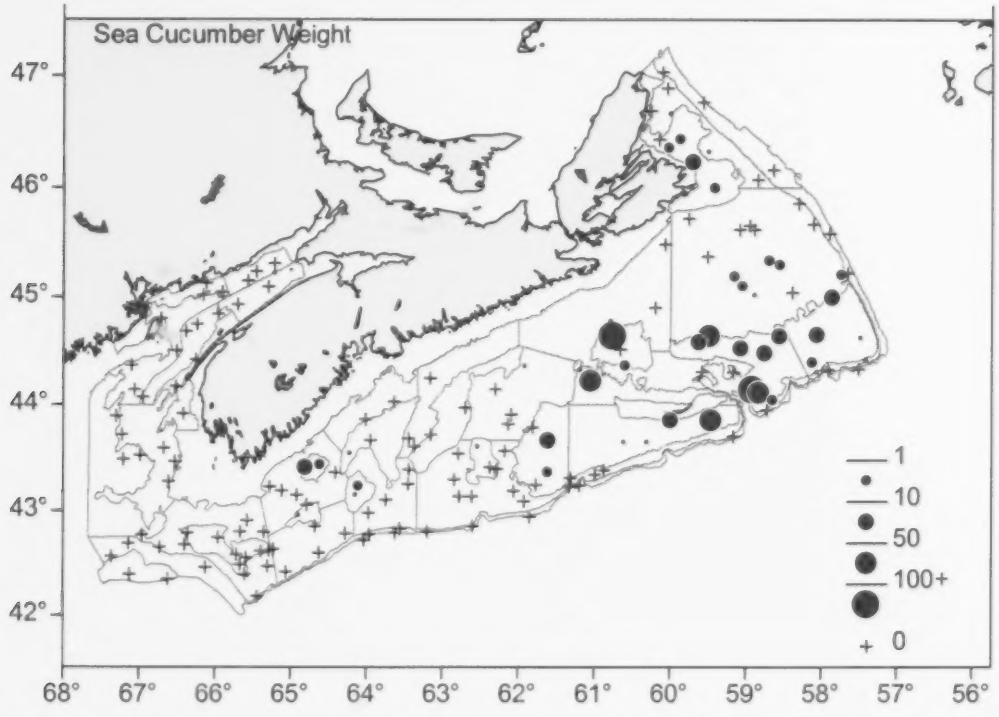

Figure 35. Distribution of sea cucumber catches during the 2008 Scotia-Fundy summer research vessel survey.

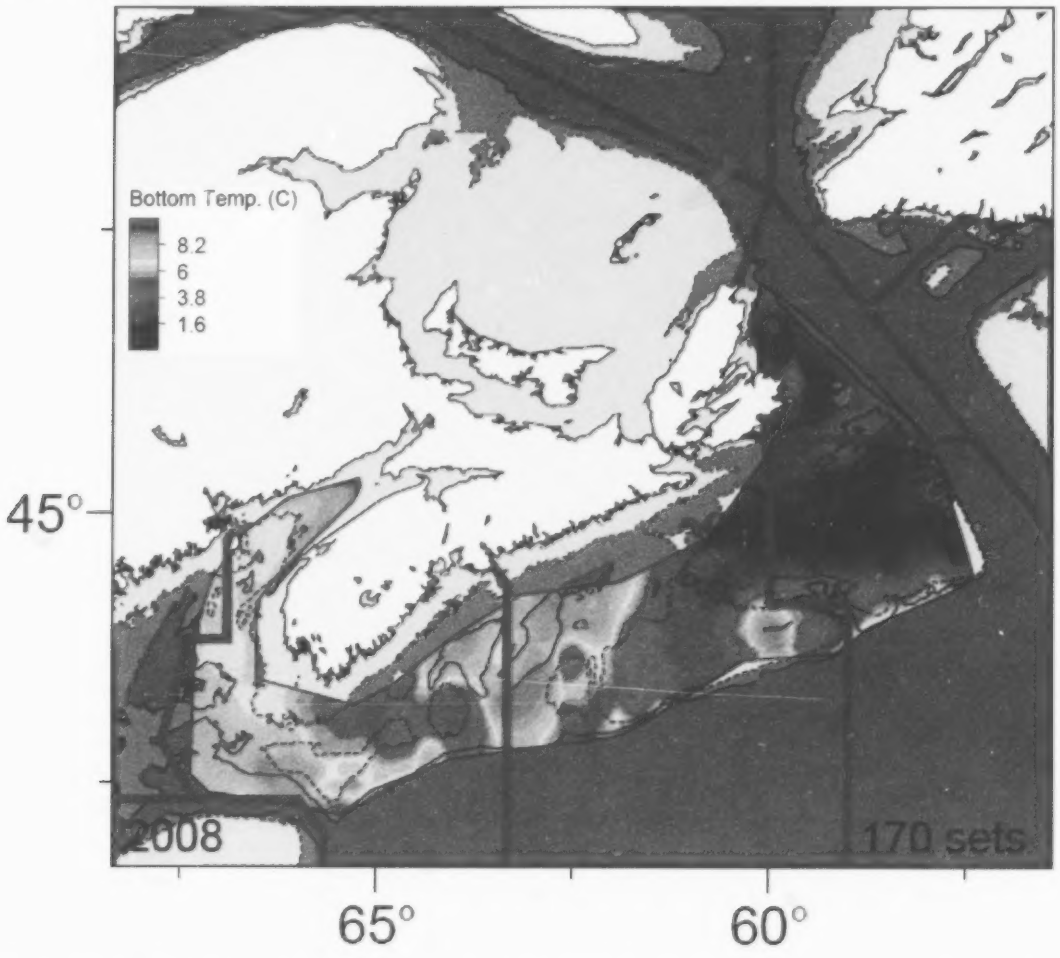

Figure 36a. Bottom temperature distribution from the 2008 Scotia-Fundy summer research vessel survey.

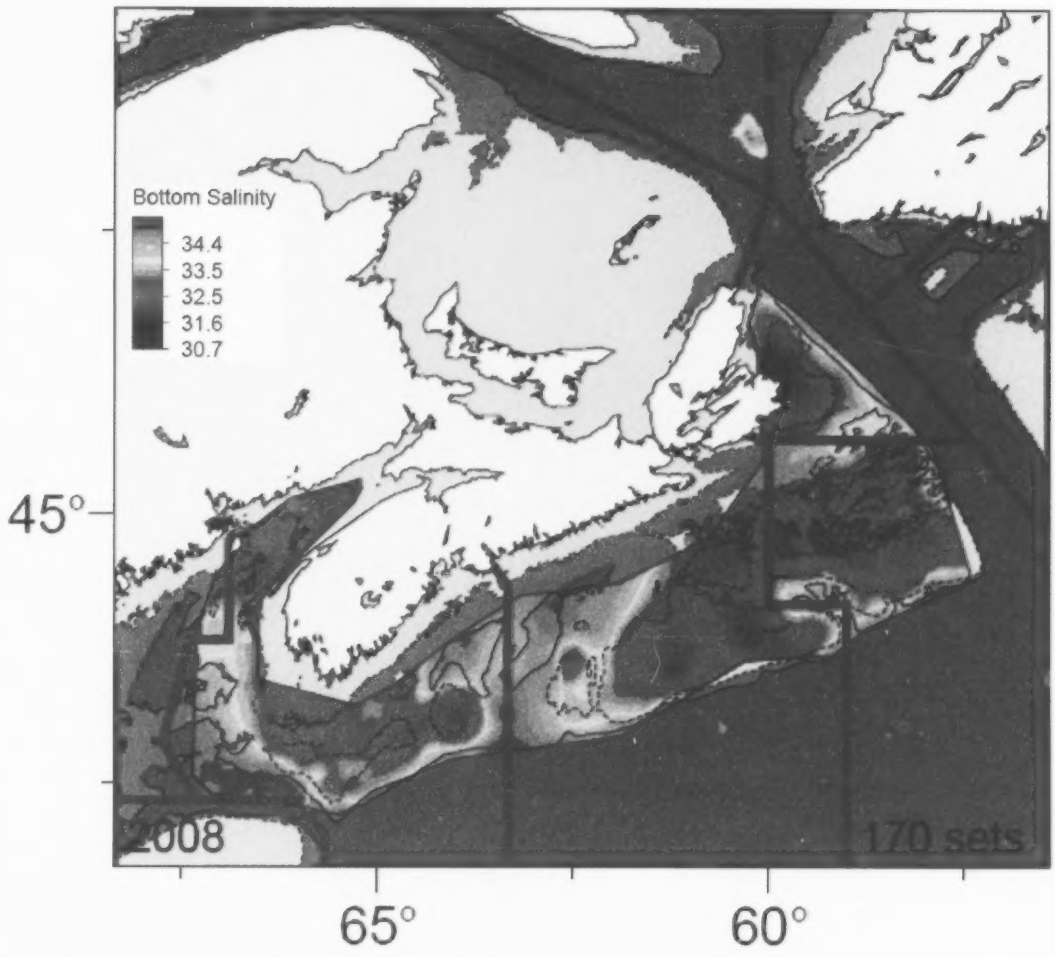

Figure 36b. Bottom salinity distribution from the 2008 Scotia-Fundy summer research vessel survey.